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8/13/97

TestAmerica-Dayton
Requested Albion QAPP Changes

VOLUME 3 OF 3
APPENDICES (CONTINUED)

REMEDIAL ACTION WORKPLAN ALBION-SHERIDAN TOWNSHIP LANDFILL CALHOUN COUNTY, MI

Prepared for
Cooper Industries
Houston, Texas

and

Corning, Inc.
Corning, New York

August, 1997

Woodward-Clyde

6465 Wayzata Boulevard
Suite 660
Minneapolis, Minnesota 55426
6E13045

APPENDIX D
FINAL REPORT

QUALITY ASSURANCE PROJECT PLAN

ALBION-SHERIDAN TOWNSHIP LANDFILL
CALHOUN COUNTY, MI

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List of Acronyms

A	Acid Fraction (extractables)
AA	Atomic Absorption
AFR	Audit Finding Report
ARARs	Applicable or Relevant and Appropriate Requirements
BN	Base Neutral Fraction (extractables)
CCB	Continuing Calibration Blank

CCC	Continuing Calibration Compounds
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Responsibility Compensation and Liability Act
CVAA	Cold Vapor Atomic Absorption
DFTPP	Decafluorotriphenylphosphine
DL	Detection Limit
DQO	Data Quality Objectives
ECD	Electron Capture Detector
FID	Flame Ionization Detector
FSP	Field Sampling Plan
GC	Gas Chromatograph
GC/MS	Gas Chromatograph/Mass Spectrometer
GFAA	Graphite Furnace Atomic Absorption
ICP	Inductively Coupled Plasma Emission Spectrophotometer
LCS	Laboratory Control Sample
LD	Laboratory Duplicate
MCL	Maximum Concentration Level
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSA	Method of Standard Additions
ND	Not Detected
ORP	Oxidation/Reduction Potential
OVA	Organic Vapor Analyzer (Flame Ionization Detector)
PE	Performance Evaluation
PQAO	Project Quality Assurance Officer
QA	Quality Assurance
QC	Quality Control
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QAU	Quality Assurance Unit
RD/RA	Remedial Design/Remedial Action
RI/FS	Remedial Investigation/Feasibility Study

ROD	Record of Decision
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RRF	Relative Response Factors
SPC	Specific Conductivity Meter
SPCC	System Performance Calibration Compounds
SOP	Standard Operating Procedures
SVOC	Semi-Volatile Organic Compounds
SW846	"Test Methods for Evaluating Solid Waste, "Third Edition, September 1986 and approved updates.
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds
WP	Work Plan
%C	Percent Completeness
%D	Percent Difference
%R	Percent REcovery
%RSD	Percent Relative Standard Deviation

REMEDIAL ACTION (RA)
QUALITY ASSURANCE PROJECT PLAN (QAPP)
ALBION-SHERIDAN TOWNSHIP LANDFILL

CALHOUN COUNTY, MICHIGAN
PREPARED BY: WOODWARD-CLYDE CONSULTANTS

Approved by: _____ _____

Jon Peterson, Remedial Project Manager — Date

U.S. EPA - Region V

Approved by: _____ _____

Superfund Quality Assurance Reviewer — Date

U.S. EPA - Region V

Approved by: _____ _____

Project Manager — Date

O&M Contractor

Approved by: _____ _____

Project QA Officer — Date

O&M Contractor

Approved by: _____ _____

Opal Davis-Johnson,QA Officer — Date

Quanterra, Inc.

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City of Albion

1.1 INTRODUCTION

The Albion-Sheridan Township Landfill Group ("Group") and Woodward-Clyde Consultants submit this Quality Assurance Project Plan (QAPP) to the United States Environmental Protection Agency (U.S. EPA), Region V, for the Remedial Action (RA) of the Albion-Sheridan Township Landfill (Site) located in Calhoun County, Michigan. The QAPP has been completed as part of the compliance requirements with the approved remedial action presented in the Record of Decision (ROD) and the Unilateral Administrative Order (UAO) for remedial design/remedial action (RD/RA), issued October 11, 1995 which took effect on December 11, 1995. The QAPP is to be used in conjunction with the following project documents:

- Operation And Maintenance Plan (O&M)
- Performance Monitoring Plan (PMP)
- Health and Safety Plan (HASP)

This QAPP describes protocols to be followed by personnel during field and laboratory sampling and analytical work. The objective of the QAPP is to provide procedures that document and ensure the precision, accuracy, completeness, and representativeness of data generated during field activities and laboratory analysis. This QAPP presents the organization, data quality objectives, functional activities and specific quality assurance (QA) and quality control (QC) activities associated with the RA activities for the Albion-Sheridan Landfill site in Calhoun County. This QAPP also describes the specific protocols which will be followed for sampling, sample handling, storage, chain of custody, and laboratory analyses.

The tasks described in this QAPP encompass all activities associated with the Operation and Maintenance (O&M) activities at the Albion-Sheridan Township Landfill Site.

1.1.1 Overall Project Objectives

The overall objective of remedial activities at the site is to implement the remedy presented in the ROD (U.S. EPA 1995). The ROD describes the remedy of the site as drum removal and construction of a cap over the landfill. The ROD states that this remedy is to reduce the risks associated with exposure to the contaminated materials on site, to eliminate or reduce migration of contaminants to the groundwater, and to reduce the risks associated with arsenic contamination in the groundwater. The ROD chose the remedial action in accordance with two threshold criteria, overall protection of human health and the environment, and compliance with the requirements of Federal and State Applicable or Relevant and Appropriate Requirements (ARARs). The ROD requires the design (RD) and implementation of the remedial action (RA) to meet the performance standards and specifications set forth in the ROD and the SOW. Performance standards shall include cleanup standards, standards of control, quality criteria and other substantive requirements, criteria or limitations including all ARARs set forth in the ROD, SOW and/or unilateral Administrative Order (UAO).

During O&M, an annual and quarterly groundwater monitoring program will be implemented as well as a landfill gas emission study to evaluate the effectiveness of the Site remedy. Six monitoring wells and seven drinking water wells will be sampled on a quarterly basis. The groundwater monitoring wells will be analyzed for field parameters, arsenic and ammonia. Field parameters include: groundwater depth/elevation before purging, temperature, pH conductivity, Eh, and dissolved oxygen. Analysis of the drinking water wells will include field parameters (less depth/elevation), Target Compound list (TCL) volatile Organic Compounds (VOCs) and 1,2-dibromo-3-chloroproprane, base / neutral and acid (BNA) extractable compounds, TAL Metals, Pesticides/PCBs, mercury, cyanide, chloride, sulfate, nitrate/nitrite and ammonia. On an annual basis, 17 monitoring wells will be sampled and submitted for analysis. The annual monitoring will be done in accordance with the SOW and consist of: 1) field parameters, and 2) chemicals of concern. Chemicals of concern will be 5 TAL chemicals (aluminum, arsenic; cobalt; manganese; and nickel), 2 TCL VOCs - benzene and vinyl chloride, and antimony, ammonia and 1,2-dibromo-3-chloropropane.

Seventeen designated monitoring wells will be sampled and analyzed for TCL organics, TAL inorganics and 1,2-dibromo-3-chloropropane to assist the EPA in meeting the requirements of Section 121(c) of CERCLA for the first five year review of the Site. Five-year review groundwater monitoring will occur approximately 50 to 52 months after approval of the Final Design.

After the groundwater analytical data from the initial year of groundwater sampling has been evaluated, analytes will be removed from the list if the provisions of the generic residential cleanup for the health based drinking water value for Public Act 307 amended, June 1995 Act 451 are met with the approval from the EPA and MDEQ. This list will be reevaluated each year upon the review of the full TCL and TAL laboratory results. A new compound may be added to the list for quarterly sampling parameters if it appears that the compound is originating from the landfill. A compound maybe dropped from the list if it is not observed during the next consecutive quarterly sampling events above the appropriate residential or industrial cleanup criteria. The quarterly and annual groundwater monitoring program are scheduled to commence following construction of the site cap (Table 1-1)

A landfill gas monitoring program will be conducted as part of the O&M monitoring activities. The objective of the gas monitoring program is to evaluate the concentrations of specific toxic pollutants under Michigan Public Act 348 and to verify that the total cancer risk level at the fence line does not exceed 1×10^{-6}. Ambient air at three selected locations (two gas vents at areas with the greatest apparent waste thickness and one downwind fenceline location) will be sampled once. These air samples will be analyzed in an off-site laboratory for a select group of VOCs. Additionally, the migration of combustible landfill gas, specifically methane, will be monitored on a quarterly basis as a percent of the Lower Explosive Limit (LEL). Direct readings of hydrogen sulfide and oxygen will also be monitored on a quarterly basis.

1.1.2 Project Status/Phase

The Group and U.S. EPA entered into a UAO for the completion of an RD/RA, which took effect on December 11, 1995. Preparation of the RD Work Plan and accompanying documents (QAPP, FSP and HASP) was the initial phase of this project. This QAPP has been primarily developed with respect to the O&M long-term groundwater and landfill gas emissions monitoring programs to assess the effectiveness of the remedial action.

This QAPP describes the O&M monitoring sampling and analyses that will be performed. As previously noted, monitoring activities during O&M will include:

- Quarterly groundwater sampling and analyses of six monitoring wells for arsenic and ammonia
- Quarterly groundwater sampling and analyses of seven drinking water wells for TCL VOCs and 1,2-dibromo-3-chloropropane, TCL BNAs, TCL pesticides/PCBs, mercury, cyanide, chloride, sulfate, nitrate/nitrite and ammonia
- Annual groundwater sampling and analysis of 12 monitoring wells for select metals (arsenic, aluminum, antimony, cobalt, manganese and nickel), select VOCs (benzene, 1,2-dibromo-3-chloropropane and vinyl chloride) and ammonia
- One time landfill gas emissions monitoring for select VOCs and quarterly monitoring for methane
- Five year review groundwater sampling and analysis of 17 monitoring wells for TCL organics and 1,2-dibromo-3-chloropropane and TAL inorganics

The results of the O&M Monitoring Program will be used to monitor the effectiveness of the remedial action and to minimize human exposure to landfill gas emissions during any phase of the remedial action.

Other additional activities that may be performed during the O&M include:

- Additional groundwater or air emissions sampling and analysis
- Refining the long term groundwater monitoring program

If these activities are added to the O&M tasks, additional addendum's to this QAPP will be submitted for approval by U.S. EPA

1.1.3 QAPP Preparation Guidelines

The QAPP has been prepared in accordance with the "Region 5 Model Superfund Quality Assurance Project Plan", dated January 1996. Other documents which have been referenced for the Albion-Sheridan Township Landfill Site RA and referenced in this QAPP include the Operation and Maintenance (O&M) Plan, Performance Monitoring Plan (PMP) and the Health and Safety Plan (HASP).

1.2 SITE/FACILITY DESCRIPTION

1.2.1 Location

The Albion-Sheridan Township Landfill is an inactive landfill located at 29975 East Erie Road approximately one mile east of Albion, Michigan on the eastern edge of Calhoun County. The landfill is approximately 18 acres in area and its boundaries are shown in figure 1 the O&M Plan.

The study area for the O&M activities includes the Site property and off-site areas immediately surrounding the Site.

1.2.2 Facility/Size And Borders

This is addressed in Section 1.1 of the O&M Plan, which is herein incorporated through reference, and in the figures which have been submitted along with the O&M Plan.

1.2.3 Topography

See Sections 1.1 of the O&M Plan for information concerning the Site's general topography.

1.2.4 Local Hydrology And Hydrogeology

See sections 2.1 and 2.2 of the O&M Plan for information concerning the Site's geology and hydrogeology.

1.3 SITE FACILITY/HISTORY

1.3.1 General History

From 1966 to 1981, the landfill was privately owned and operated by Mr. Gordon Stevick. The landfills accepted municipal refuse and industrial wastes from households and industries in the City of Albion and nearby townships. In the early 1970's, the Michigan Department of Natural Resources (MDNR) approved the landfill to accept metal plating sludges. Other materials, such as paint wastes and thinners, oil and grease, and dust, sand, and dirt containing fly ash and casting sand were also disposed of at the site. In 1980, the MDNR collected and analyzed samples of non-containerized sludges that were being disposed at the site. The sludges contained heavy metals, including chromium (250,000 mg/kg), zinc (150,000 mg/kg), nickel (1,000 mg/kg) and lead (280 mg/kg). The sludges remain buried at the Site. The landfill ceased operation in 1981.

1.3.2 Past Data Collection Activities

Investigations and/or remedial actions conducted to date include:

- 1986 - A U.S. EPA Field Investigation Team (FIT) Contractor, performed a site screening inspection for scoring the site per the Hazard Ranking System (HRS). Based on the HRS, the Site was included on the National Priorities List (NPL) and designated as a Superfund Site.
- 1988 and 1989 - Site inspections conducted by a U.S. EPA Technical Assistance Team (TAT) resulted in a 1990 removal action of approximately forty-six (46) drums containing various RCRA hazardous waste. The removal action was conducted in accordance with a Unilateral Administrative Order (UAO, March 1990).
- 1992 through 1995 - U.S. EPA conducted a Remedial Investigation/Feasibility Study (RI/FS) for the Site, pursuant to CERCLA and the National Contingency Plan.
- The FS work culminated with the U.S. EPA ROD of March 1995, which described the selection of the remedial action to be implemented at the Site.
- 1996 - WCC conducted a Pre-Design Studies which included monitoring well installation, horizontal and vertical extent of waste verification and groundwater sampling and analysis.

1.3.3 Current Status

Based on reports and documents reviewed for the site, and a current assessment of all available information, the following summarizes the current status of conditions at the Albion-Sheridan Township Landfill.

The landfill is currently covered with 1 to 4 feet of silty sand with refuse scattered at the surface, including metal, plastic, concrete, asphalt, 55-gallon drums, wood, tires, a storage tank and a junk crane. Test pitting conducted by MDNR uncovered one area of concentrated drum disposal where an estimated 200 to 400 drums are present. Some of the drums contain liquid and solid wastes and suspected paint sludges, including up to 2.7 parts per million (ppm) arsenic, 730,000 ppm 1,2,4-trimethyl benzene, 40,000 ppm m&p xylenes, 6,500 ppm acetone and 2,400 ppm aluminum.

The landfill ranges from 16 to 35 feet in thickness and is producing landfill gasses in the form of volatile organic compounds (VOCs) in concentrations in excess of 10,000 ppm. The landfill waste contains numerous organic contaminants, including 10 VOCs, 19 semi-volatile compounds (SVOCs), 11 pesticides/PCBs, and inorganic contaminants including antimony, arsenic, chromium, copper, lead, mercury and zinc.

A leachate plume extends southwest of the landfill for approximately 900 feet and extends vertically to a depth of approximately 45 feet below the water table. The RI found landfill constituents in groundwater extending southwest of the landfill for approximately 900 ft and extending vertically to a depth of approximately 45 ft below the water table. The unconsolidated aquifer plume contained 1,2-dibromo-3-chloropropane and antimony at concentrations above their respective federal Maximum Contaminant Level (MCL). The bedrock aquifer plume

contained vinyl chloride at the MCL and arsenic above the MCL, at concentrations up to 126 µg/l.

The results of the Pre-Design Studies indicated that overall, shallow glacial monitoring well samples exhibited similar results as those obtained during the RI. The only organic compounds detected included vinyl chloride (MW03SG at 1.0 µg/l), chloroethane (MW07SG at 1.0 µg/l) and bis (2-Ethylhexyl) phthalate (MW05SG at 6.4 µg/l). Arsenic was detected in 2 wells, MW04SG and MW07SG, at concentrations of 7.9 µg/l and 13.2 µg/l, respectively. The results of the Pre-Design Studies also indicated that overall, bedrock monitoring well samples exhibited similar results as those obtained during the RI. There were no VOCs or SVOCs detected. The only inorganic analyte detected above the 50 µg/l MCL was Arsenic in MW06SB at 130 µg/l.

1.4 PROJECT OBJECTIVES

Data Quality Objectives are qualitative and quantitative statements which specify the quality of the data required to support decisions made during the O&M activities and are based on the end uses of the data collected. As such, different data uses may require different levels of data quality.

1.4.1 Specific Objectives And Associated Tasks - O&M Monitoring

Long-term groundwater monitoring will be used to evaluate the effectiveness of the cap integrity. The groundwater monitoring plan will provide pertinent background information and fulfill the requirements of the Michigan Solid Waste Rules under Act 641 and the Hazardous Waste Rules under Act 64.

The objective of the gas monitoring plan is to evaluate the concentrations of specific toxic pollutants that are regulated under Michigan Public Act 348 and to verify that the total cancer risk at the fence line does not exceed $1x10^{-6}$.

1.4.2 Project Target Parameters And Intended Data Usage - O&M Monitoring Program

Field Parameters

The following equipment will be used to obtain field parameter data:

Groundwater

- Water level meter for measuring groundwater depth/elevations
- Thermometer, conductivity meter, dissolved oxygen meter, oxidation-reduction meter, and pH meter for monitoring well development and sampling
- Bladder pump and dedicated tubing to be used for monitoring well sampling

Air Monitoring

Gas monitoring screening will be performed using specific monitors able to detect or quantify and methane.

Laboratory Parameters

The Project target limits (PTLs) are defined as those concentrations that laboratory analytical procedures should achieve to meet the project objectives. These PTLs should not be considered "cleanup" criteria at the site but rather laboratory performance criteria.

The Target Method Detection Limits (TMDLs) for groundwater to be used for laboratory analyses are in accordance with the TMDLs established by the Michigan Department of Natural Resources (MDNR) in MERA Operational Memorandum #6, Revision #4 dated September 13, 1995.

Groundwater

Groundwater samples from six monitoring wells for the O&M monitoring will be analyzed for arsenic and ammonia on a quarterly basis. Seven drinking water wells will be analyzed for TCL organics plus 1,2-dibromo-3-chloropropane, mercury, cyanide, chloride, sulfate, nitrate/nitrite and ammonia. Twelve monitoring wells will be sampled and analyzed on an annual basis for select metals (arsenic, aluminum, antimony, cobalt, manganese and nickel), select VOCs (benzene, 1,2-dibromo-3-chloropropane and vinyl chloride) and ammonia. Seventeen monitoring wells will be sampled as part of the five year review and will be analyzed for TCL organics and 1,2-dibromo-3-chloropropane and TAL inorganics. Detection limits are further discussed in Section 7.0 (see Tables 7-4 and 7-5).

Air Samples

Ambient air samples will be analyzed for select VOCs including: 1,2-dichloroethene, benzene, tetrachloroethene, chloroform, methylene chloride, vinyl chloride, 1,1-dichloroethene, trichlorethene, and carbon tetrachloride.

The results of the O&M Monitoring will be used to assess the effectiveness of the remedial action and to minimize exposure to landfill gas emissions.

1.4.3 Data Quality Objectives

EPA Guidance (U.S. EPA 1987) tailors the analytical methodology to watch the intended use of the data. In general, the five analytical levels are:

- Level I - field screening or analyses using portable instruments;
- Level II - field analyses using more sophisticated portable analytical instruments, possibly setup in a mobile laboratory;

- Level III - analyses performed at an off-site geotechnical or analytical laboratory but without the validation or documentation procedures required of the Contract Laboratory Program (CLP) Level IV analyses;
- Level IV - CLP (or CLP-like) routine analytical services; and
- Level V - analysis by non-standard methods;

Data validation procedures are provided in Section 9.0. To meet the objectives of the UAO, the following qualitative DQOs were identified:

Screening: The following measurements will be used under DQO Level I to collect and obtain basic site characteristics:

- Field Parameter Data: pH, temperature, specific conductance, oxidation-reduction potential, dissolved oxygen, and water levels/elevations
- Compile or acquire basic geologic and hydrogeologic information such as existing water table maps. These data will be used to further define migration pathways and background conditions in the area of the site.

The data acquired under DQO Level I will be used to detect changes in groundwater characteristics between sampling rounds, to describe basic physical properties of media investigated, and to verify adequate purging of monitoring wells. Water level elevations will be measured to map the water table and to calculate groundwater flow gradients by following standard contouring protocols.

Field Analysis: The following field analysis procedures will be used under DQO Level II. They will be used to generate data, if required, to evaluate the gas emissions from the landfill.

- Landfill gas samples: methane.
- DQO Level II data such as samples of landfill gas, will be used to assess the composition, relative quantity and location of gas production within the landfill area and to assess the presence of air emission constituents which are regulated under Michigan Public Act 348.

Off-site Laboratory Analyses Ambient Air Samples: This provides a level of data quality suitable for site characterization. Analyses may include mobile lab generated data and some analytical lab methods (e.g., laboratory data without DQO Level IV type quality control documentation).

Ambient air samples analyzed for chemicals of concerns (volatiles) will be required during the O&M Monitoring. The contract laboratory will use Method T0-14 for ambient air monitoring analyses.

Off-Site Laboratory Analyses Groundwater Samples: SW-846 analytical methods with an increased level of QA/QC will be used in place of CLP methodologies for groundwater sample analyses conducted during the O&M Monitoring. The data will be presented in CLP-type deliverables. Data validation procedures are performed according to U.S. EPA recognized

protocol. The methods are discussed in Section 7.0 and detection limits are discussed on Section 7.0.

Non-Standard Laboratory Analyses: No DQO Level V data are planned to be collected during the O&M Monitoring.

1.5 SAMPLE NETWORK DESIGN AND RATIONALE

The sample network design and rationale for sample locations is explained in detail in the PMP.

1.5.1 Laboratory Analysis Parameters and Sample Frequency

Sample matrices, analytical parameters and frequencies of sample collection is presented in Table 1-1.

1.5.2 Site Maps Of Sampling Locations

Maps showing intended ground water sampling locations are included as Figures in the O&M Plan, which is fully incorporated into this QAPP through reference. It is possible however, that depending on the nature of encountered field conditions some of these locations will be changed if approved by U.S. EPA. The person who shall be responsible for making such decisions will be the Site Field Manager whose responsibilities are described in Section 2.0 of this QAPP. Monitoring well screen depth are also indicated in the O&M Plan.

1.5.3 Rationale of Selected Sampling Locations

The rationale for why the selected sampling locations were chosen in conjunction with the area of concern is fully described in the O&M Plan and SOW.

A summary of the sampling and analysis plan for the O&M Monitoring is presented in Table 1-1 of this document. Table 1-1 will be revised by addenda if required, and prior to additional monitoring during subsequent phases of the O&M Monitoring Program.

1.6 PROJECT SCHEDULE

The initial quarterly groundwater sampling and analysis event will occur after cap construction is completed following EPA approval of the Final Construction Report. Thereafter, groundwater sampling and analysis will be conducted on a quarterly basis for the first five years of the monitoring program.

The sampling schedule may be modified in the future with the approval of U.S. EPA and consultation with MDEQ.

At the direction of the U.S. EPA's Remedial Project Manager, The Project Coordinator has overall responsibility for all phases of the RD/RA. The Project Coordinator assigned by Cooper Industries and Corning Corporation (Group) for this RD/RA project is Mr. John Seymour of Woodward-Clyde Consultants (WCC). The Project Coordinator will be responsible for the direction and supervision of work performed by the O&M Contractor pursuant to the UAO. The various quality assurance and management responsibilities of key project personnel are defined below.

2.1 PROJECT ORGANIZATION CHART

The lines of authority for the Remedial Action can be found in Figure 2-1. The chart includes all individuals discussed below.

2.2 MANAGEMENT RESPONSIBILITIES

2.2.1 U.S. EPA Remedial Project Manager

Mr. Jon Peterson has overall responsibility for all phases of the RD/RA. He will provide review and approval of work plans, QAPPs, reports, schedules, and specifications.

2.2.2 Group Authority and Responsibility

The Group will manage the overall project. The Group's Project Coordinator and the O&M Contractor's technical resources will be utilized as needed for specific areas of application and to accomplish specific tasks associated with the O&M Monitoring Program. The Group, Project Coordinator and the O&M Contractor will work together to assure that project resources are effectively utilized to meet schedules, budgets, and quality requirements.

The Group's responsibilities will include reporting to regulatory agencies, supervising and reviewing the Project Coordinator's and the O&M Contractor's work. This will assure that the work performed meets technical commitments, by evaluating permit condition compliance including scheduled commitments

2.2.3 Project Coordinator

Mr. John Seymour of WCC will be the Project Coordinator for the Group during the O&M activities. The Project Coordinator will report directly to the Group.

2.2.4 O&M Contractor's Project Manager

The O&M Contractor's Project Manager has overall responsibility for ensuring that the project meets U.S. EPA's objectives and quality standards. The Project Manager will provide assistance to the Group in terms of writing and distribution of the QAPP to all those parties connected with

the project (including the laboratory). The Project Manager is responsible for technical quality control and project oversight. The Project Manager will report directly to the Group.

2.3 QUALITY ASSURANCE RESPONSIBILITIES

The Group's QA Manager

The Group's QA Manager will remain independent of direct job involvement and day-to-day operations. He will have direct access to corporate executive staff, necessary to resolve any QA dispute. He is responsible for oversight of the QA program in conformance with the demands of specific investigations, the O&M Contractor's policies, and U.S. EPA requirements. Specific functions and duties include:

- Providing QA oversight on various phases of the field operations;
- Reviewing and approving of QA plans and procedures;
- Providing QA technical assistance to project staff;
- Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the remainder of the Group.

O&M Contractor's QA Manager

The O&M Contractor's QA Manager will report directly to the O&M Project Manager, and will be responsible for ensuring that all procedures for the O&M Monitoring Program are being followed. In addition, the QA Manager will be responsible for the data validation, verifying that sampling and analytical operations are carried out according to the Quality Assurance Project Plan. Audits of systems will also be conducted. The QA Manager or designee shall be responsible for performance and system audits of field, laboratory and data reduction/verification activities, and specifying corrective action as required. The QA Manager will review field QC test results, laboratory operations, and prepare QA reports.

U.S. EPA Region V Technical Support Section Quality Assurance Reviewer (RQAR)

The U.S. EPA RQAR has the responsibility to review and approve all Quality Assurance Project Plans (QAPPs). Additional EPA responsibilities for the project include:

- Conducting external Performance and System Audits of project laboratory(ies)
- Reviewing and evaluating analytical laboratory and field procedures

2.4 LABORATORY RESPONSIBILITIES

The Quanterra Environmental Services Laboratory in North Canton, Ohio, will perform analytical services during the O&M Monitoring Program. Specific analyses and matrices that

Quanterra laboratories will analyze and the protocols they will follow are described in other sections of this QAPP.

Quanterra Laboratories Project Manager - Ms. Alesia Danford

The Quanterra Laboratories Project Manager will report directly to the O&M Contractor's Project Manager. She will be responsible for the following:

- Ensuring all resources of the laboratory are available on an as-required basis; and
- Overviewing of final analytical reports.

Quanterra Laboratories Operations Manager - Mr. Chris Oprandi

The Quanterra Laboratories Operations Manager will report to the Quanterra Laboratories Project Manager and will be responsible for:

- Coordinating laboratory analyses Supervising in-house chain-of-custody
- Scheduling sample analyses
- Overseeing data review
- Overseeing preparation of analytical reports
- Approving final analytical reports prior to submission to the Group and the O&M Contractor

JAO 10/14

Quanterra Laboratories Quality Assurance Officer - Ms. Opal Davis-Johnson

Quanterra's Laboratory QA Officer has the overall responsibility for data after it leaves the laboratory. The QA Officer will be independent of the laboratory but will communicate data issues through the laboratory's Project Manager. In addition, the laboratory QA Officer will:

- Overview laboratory quality assurance
- Overview QA/QC documentation
- Conduct detailed data review
- Determine whether to implement laboratory corrective actions
- Define appropriate laboratory QA procedures
- Prepare laboratory Standard Operation Procedures
- Sign the title page of the QAPP

Quanterra Laboratories Sample Custodian - Ms. Lois Ezzo

The sample custodian will report to the laboratory Operations Manager. Responsibilities of the sample custodian will include:

- Receiving and inspecting the incoming sample containers
- Recording the condition of the incoming sample containers
- Signing appropriate documents
- Verifying chain-of-custody and its correctness
- Notifying laboratory manager and laboratory supervisor of sample receipt and inspection
- Assigning a unique identification number and customer number, and entering each into the sample receiving log
- Initiating transfer of the samples to the appropriate lab sections, with the help of the laboratory manager
- ~~Controlling and monitoring access/storage of samples and extracts~~ JAD 10/14

Final responsibility for project quality rests with Quanterra's Project Manager. Independent quality assurance will be provided by the Quanterra's Project Manager and QA Officer prior to release of all data to the Group and the and the O&M Contractor.

Quanterra Laboratories Technical Staff

Quanterra Laboratories technical staff will be responsible for sample analysis and identification of corrective actions. The staff will report directly to the laboratory Operations Manager.

2.5 FIELD RESPONSIBILITIES

The Group will be supported by the O&M Contractor Field Manager. The Field Manager is responsible for leading and coordinating the day-to-day activities of the various resource specialists under his/her supervision. The Field Manager is an experienced environmental professional and will report directly to the O&M Contractor Project Manager. Specific Field Manager responsibilities include:

- Providing day-to-day coordination with his/her Project Manager on technical issues in specific areas of expertise;
- Developing and implementing field-related work plans, assurance of schedule compliance, and adherence to management-developed study requirements;
- Coordinating and managing field staff including sampling and drilling, and supervising field laboratory staff;
- Implementing QC for technical data provided by the field staff including field measurement data;
- Writing and approving text and graphics required for field team efforts;

- Coordinating and overseeing technical efforts of subcontractors assisting the field team;
- Identifying problems at the field team level, resolving difficulties in consultation with the Project Manager, implementing and documenting corrective action procedures, and providing communication between team and upper management; and
- Participating in data validation and in preparation of the final report.

2.6 CONTRACTORS

The Group anticipates contracting an O&M Manager (O&M Contractor), laboratory services, and related contractors for such services as drilling and surveying during the O&M Monitoring Program. The companies chosen will have contractual obligations to the Group but will work under the direction of the O&M Contractor. The Group will inform U.S. EPA when these services are contracted.

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody documentation, laboratory analysis, and reporting that will provide results that are of known quality and useable to meet project objectives. Specific procedures for calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP. This section addresses the specific objectives for completeness, representativeness, comparability, accuracy, and precision of analysis.

Data that are incidental to collecting samples for analytical testing or unrelated to sampling will be generated during many of the field activities. These activities include, but are not limited to:

- Documenting time and weather conditions
- Locating and measuring the elevation of sampling stations
- Determining depths in a well
- Static water level measurements
- Calculating well development and pre-sampling purge volumes
- Observing sample collection conditions

The general QA objective for such field data is to obtain reproducible and comparable measurements to a degree of accuracy consistent with the intended use of such data through the documented use of standard procedures.

3.1 PRECISION

3.1.1 Definition

Precision is defined as the reproducibility of the analysis under prescribed similar conditions. Any variability in the reported analysis is attributed to variability introduced by sampling, handling, or analytical procedures. Precision can be expressed as relative percent difference (RPD) between duplicate analyses or as percent relative standard deviation (%RSD) between multiple data points. Equations to calculate precision are given in Section 12.0.

3.1.2 Field Precision Objectives

- Precision goals for pH measurement for replicate samples are ± 0.2 standard pH units.
- Precision goals for the specific conductivity meter are consecutive readings with ten percent of each other. Precision will be assessed through replicate measurements.
- The precision of temperature readings will be assessed by performing replicate readings. These readings must be within one degree Celsius of the original readings.

- Precision of Oxidation/Reduction (Redox) Potential measurements will be assessed through replicate measurements. The replicate measurements must be within ± 5 millivolts of the original measurement.
- The precision of dissolved oxygen (DO) measurements will be accessed by performing replicate measurements. The replicate measurements must be within ± 0.2 mg/l of the original measurement.
- Precision goals for field screening of landfill gas emissions will be assessed by performing replicate readings.

3.1.3 Laboratory Precision Objectives

The precision of laboratory analyses will be measured by testing spiked samples and duplicates in accordance with the frequencies shown in Table 1-1. Matrix spikes and matrix spike duplicates will be analyzed for every ~~10~~ 20 investigative samples. Precision criteria for the parameters to be tested are shown in Table 3-1. SAD 10/14

Additionally, one duplicate sample will be collected in the field for every 10 investigative groundwater samples. It will be labeled as a completely separate sample with no notation as to which original sample it duplicates, and it will be submitted as a blind duplicate sample to the lab. The same set of analyses as the original sample will be performed. Since the samples will not be spiked, there will be less information due to non-detected compounds. However, an RPD can be calculated for duplicate sample data in the same way as duplicate spiked samples. Because of matrix effects, no criteria are set for the RPD, but this information will be used in estimating uncertainty in the aggregate sampling and analytical precision for this project.

3.2 ACCURACY

3.2.1 Definition

Accuracy is defined as a bias in the measurement, either low or high from the true value. The accuracy or bias of a laboratory analysis is evaluated by analyzing standards of known concentration both before and during sample analysis. Bias also is evaluated by spiking a sample with a known quantity of a chemical and measuring its actual, versus expected, recovery. Similarly, any bias introduced by laboratory contaminants are detected during blank analysis. Accuracy can be expressed as percent recovery (%R) of a spiked analyte. The formula to calculate accuracy is presented in Section 12.0 of this QAPP.

3.2.2 Field Accuracy Objectives

The accuracy of field measurements of pH will be assessed through pre-measurement calibrations and post-measurements verifications using at least three standard buffer solutions. The calibration measurement must be within ± 0.1 standard units for the buffer solution values.

Post-measurement verification will be accomplished using different containers of buffer solutions than the container used for pre-measurement calibration.

The accuracy of field measurements for specific conductivity will be assessed by performing pre-measurement calibration and post-measurement verifications. The calibration measurement must be within ± 20 micromhos/cm of the true value of the calibration solution. Post-measurement verification will be accomplished using a different container of standard calibration solution than the container used for pre-measurement calibration.

The accuracy of field measurements of Redox will be assessed through pre-measurement calibrations and post-measurement verifications using a standard reference solution.

The accuracy of temperature readings will be ensured by using thermometers certified by the National Institute of Standards and Technology.

The accuracy of field measurements of DO will be assessed through pre-measurement calibration to ambient air and post measurement evaluation of instrument drift using ambient air as the reference.

Field screening of landfill gas emissions will be performed for methane. Accuracy objectives will be in accordance with the manufacturer's recommendations.

The accuracy of conductivity measurements will not be assessed during the investigation. The survey yields apparent indicators of conductivity to identify changes in this property; absolute or true values are not important to the investigation.

3.2.3 Laboratory Accuracy Objectives

The accuracy of laboratory analyses will be measured by testing of spiked samples in accordance with the frequencies shown in Table 1-1. Matrix spikes and matrix spike duplicates will be analyzed for every 20 investigative samples. Method blanks and Laboratory Control Samples (LCS) will be analyzed one for every analytical batch. Surrogates will be analyzed for every sample and every blank, spike, and control sample. Accuracy criteria for the parameters to be tested are shown in Tables 3-1 and 3-2 , WHERE APPROPRIATE,

3.3 COMPLETENESS

3.3.1 Definition

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was planned to be obtained or requested under normal conditions.

3.3.2 Field Completeness Objectives

Field completeness is a measure of the amount of valid measurements obtained from all the field measurements planned in the project. The equation for completeness is presented in Section 12.0 of this QAPP. Field completeness for this project will be greater than 90 percent.

3.3.3 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid measurements obtained (including estimated values) from all the measurements planned in a project. The equation for completeness is presented in Section 12.0 of this QAPP. Laboratory completeness for this project will be greater than 90 percent.

3.4 REPRESENTATIVENESS

3.4.1 Definition

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and proper laboratory protocol.

3.4.2 Measures to Ensure Representativeness of Field Data

Representiveness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the project standard operating procedures (SOPs) for field sampling (see Attachment A to the O&M Plan) are followed and that proper sampling techniques are used.

3.4.3 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory is ensured by using the proper analytical procedures, meeting sample holding times and analyzing and assessing field duplicated samples. The sampling network was designed to provide data representative of facility conditions. During development of this network, consideration was given to past waste disposal practices, existing analytical data, physical setting and processes, and constraints inherent to the Superfund program. The rationale of the sampling network is discussed in detail in the PMP.

3.5 COMPARABILITY

3.5.1 Definition

Comparability is an expression of the confidence with which one data set can be compared with another.

3.5.2 Measures to Ensure Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring the PMP is followed and that proper sampling techniques are used.

9.1 DATA REDUCTION

9.1.1 Field Data Reduction Procedures

Field measurements are taken directly from instrument readings; therefore, no data calculations are involved. Field data reduction consists of transcribing and organizing these data into tables. This task will be performed by the Contractor's O&M Field Team and Field Manager.

9.1.2 Laboratory Data Reduction Procedures

Laboratory data reduction procedures will be followed according to the following protocol:

- Raw data produced and checked by the responsible analyst is turned over for independent review by another analyst
- The area supervisor or senior chemist reviews the data for attainment of quality control criteria established by the QAPP (see Tables 3-1, 3-2, and 4-1)
- Upon completion of all reviews and acceptance of the raw data by the laboratory area supervisor, a report will be generated and sent to the laboratory Project Manager
- The laboratory Project Manager will complete a thorough inspection of all reports
- The QA Officer and/or area supervisor will decide whether any sample reanalysis is required
- Upon acceptance of the preliminary reports by the QA Officer, final reports will be generated and signed by the Project Manager

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Specific equations used for data reduction are contained in the SOPs in Attachment A.

9.2 DATA VALIDATION

Data validation procedures will be performed for both field and laboratory operations as described in the following subsections.

9.2.1 Procedures Used to Evaluate Field Data

Procedures to evaluate field data for this project primarily include checking for transcription errors and review of field logbooks, on the part of field sampling team. This task will be the responsibility of the Field Manager.

9.2.2 Procedures to Validate Laboratory Data

Validation of the analytical data will be performed by the O&M Contractor's QA Officer or designee based on the pertinent evaluation criteria outlined in "National Functional Guidelines

for Organic Data Review", February 1994 and "National Functional Guidelines for Inorganic Data Review", February 1994, on 100 percent of the data as described below:

The following deliverables will be evaluated in the data validation:

Organic Analyses

i) technical holding times
ii) GC/MS tuning/mass calibration
iii) initial and continuing calibration
iv) blanks
v) surrogate spikes
vi) MS/MSD results
vii) internal standard performance
viii) target compound identification and quantitation
~~ix) tentatively identified compounds~~ JAO 10/14
x) system performance
xi) GC/ECD instrument performance check (Pesticides/PCBs)
xii) pesticide cleanup checks, if performed (Pesticides/PCBs)
xiii) field duplicates

Inorganic Analyses

i) technical holding times
ii) calibration
iii) blanks
iv) interference check samples
v) laboratory control samples
vi) duplicate sample analysis
vii) matrix spike sample analysis
viii) furnace atomic absorption QC
~~ix) ICP serial dilution~~ JAO 10/14
x) sample result verification
xi) field duplicates

9.3 DATA REPORTING

Data reporting procedures will be carried out for field and laboratory operations as described in the following subsections.

9.3.1 Field Data Reporting

Field data reporting will be conducted principally through the transmission of report sheets containing tabulated results of all measurements made and documentation of all calibration activities.

9.3.2 Laboratory Data Reporting

The task of reporting laboratory data to the U.S. EPA begins after the validation activity has been concluded. The laboratory Project Manager will perform a final review of the report summaries and case narratives to determine whether the report meets the project requirements. In addition to the record of the chain-of-custody, the report format shall consist of the following:

1. Case Narrative
   - i) date of issuance
   - ii) laboratory analysis performed
   - iii) any deviations from intended analytical strategy
   - iv) laboratory batch number
   - v) number of samples and respective matrices
   - vi) quality control procedures utilized and also references to the acceptance criteria
   - vii) laboratory report contents
   - viii) project name and number
   - ix) condition of samples "as received"
   - x) discussion of whether or not sample holding times were met
   - xi) discussion of technical problems or other observations which may have created analytical difficulties
   - xii) discussion of any laboratory quality control checks which failed to meet project criteria
   - xiii) signature of laboratory ~~QA Manager~~ PROJECT MANAGER JAP 10/14

2. Chemistry Data Package

   i) case narrative for each analyzed batch of samples

   ii) cross referencing of laboratory sample to project sample identification numbers

   iii) description of data qualifiers to be used

   iv) methods of sample preparation and analyses for samples

   v) sample results

   vi) raw data for sample results and laboratory quality control samples

   vii) results of (dated) initial and continuing calibration checks and GC/MS tuning results

   viii) matrix spike and matrix spike duplicate recoveries, laboratory duplicate analytical results, laboratory control samples, method blank results, calibrations check compounds and system performance check compound results

   ix) labeled and dated chromatograms/spectra/instrument output of sample results and laboratory quality control checks

   ~~x) results of tentatively identified compounds~~ JAO 10/14

The data package submitted will be a "CLP-like" data package consisting of all the information presented in a CLP data package but not necessarily on CLP forms.

Performance and system audits conducted by the O&M Contractor shall be performed to:

- Verify that QA program is documented in accordance with specified requirements
- Verify documented program has been implemented
- Assess the Effectiveness of the QAPP
- Identify any non conformances
- Verify correction of identified deficiencies

This QA program operates independently of the overall project structure. The Audit Flowchart (Figure 10-1) summarizes the audit procedures established in this section. The O&M Contractor's Quality Assurance Officer (QAO) shall be responsible for initiating audits, selecting the audit team and overseeing the audit implementation. The QAO in consultation with the O&M Contractor's Project Manager, shall perform audits to coincide with appropriate activities on this project.

10.1 FIELD PERFORMANCE AND SYSTEMS AUDITS

Internal system audits on field work performance will be conducted by the O&M Contractor's QAO at least once yearly and as considered appropriate throughout the duration of the project. The Field Manager is responsible for supervising and checking that samples are collected and handled in accordance with the approved project plans and that documentation of field work is adequate and complete. The Project Manager is responsible for overseeing that the project performance satisfies the QA objectives, as set out in this QAPP. The O&M Contractor's QAO may also conduct unannounced field audits.

A field audit checklist (Figure 10-2) will be used to conduct field audits at the site during any phase of the RD/RA. Audits will examine adherence to protocol specified for items such as sample collection, sample handling, QA/QC sample collection, equipment calibration, equipment maintenance, field logbook documentation, and chain-of-custody preparation.

Follow-up audits may be performed to verify that any previously identified deficiencies were corrected. Corrective actions (Section 13.0) may be identified and recommended. An external audit may be conducted by U.S. EPA Region V personnel at any time.

10.2 LABORATORY PERFORMANCE AND SYSTEMS AUDITS

10.2.1 Internal Laboratory Audit Responsibilities

The internal laboratory audit will be conducted by the O&M Contractor's QAO.

10.2.2 Internal Laboratory Audit Frequency

The internal laboratory system audits will be performed on an annual basis while the internal laboratory performance audits will be conducted on a quarterly basis over the duration of O&M Monitoring Program any time laboratory analyses are required.

10.2.3 Internal Laboratory Audit Procedures

The internal laboratory system audits will include an examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation and analysis, and instrument operating records. The performance audits will involve preparing blind QC samples and submitting them along with project samples to the laboratory for analysis throughout the project. The O&M Contractor's QAO will evaluate the analytical results of these blind performance samples to ensure the laboratory maintains acceptable QC performance.

Follow-up audits may be performed to verify that any previously identified deficiencies were corrected. Corrective actions (Section 13.0) may be identified and recommended.

10.2.4 External Laboratory Audit Frequency

An external laboratory audit will be conducted at least once prior to the initiation of the sampling and analysis activities. These audits may or may not be announced and are at the discretion of the U.S. EPA.

10.2.5 Overview of the External Laboratory Audit Process

External laboratory audits will include (but not be limited to) review of laboratory analytical procedures, laboratory on-site audits, and/or submission of performance evaluation samples to the laboratory for analysis.

11.1 FIELD INSTRUMENT PREVENTIVE MAINTENANCE

Standard Operating Procedures are presented in Attachment A of the O&M Plan. Table 11-1 provides the frequency of service for field instruments.

11.2 LABORATORY INSTRUMENT PREVENTIVE MAINTENANCE

As part of their QA/QC program, a routine preventive maintenance program is conducted by Quanterra to minimize the occurrence of instrument failure and other system malfunctions. Designated laboratory employees will regularly perform routine scheduled maintenance and repair of (or coordinate with the instrument manufacturer for the repair of) all instruments. All maintenance that is performed shall be documented in the laboratory's maintenance logbooks. All laboratory instruments are maintained in accordance with manufacturer's specifications.

Table 11-1 provides the frequency which components of key analytical instruments or equipment will be serviced.

12.1 CALCULATION OF DATA QUALITY INDICATORS

Quanterra uses specific routine procedures to assess the precision, accuracy, and completeness of its analytical data. The Laboratory's objective for precision and accuracy is to equal or exceed the stated performance in the method. These measures include the validation and internal quality control procedures discussed in Sections 7 and 8.

Precision, Accuracy and Completeness

Quantitation of precision and accuracy for field measurements are described in Section 3.0.

Specific procedures for assessing data accuracy and precision include calculation of percent recoveries for all laboratory check samples (LCS) and surrogates and relative percent differences (RPD) for all duplicate spike sample analyses. These calculations are summarized below.

a. Accuracy = Percent Recovery = $\frac{\text{(Amount in spiked sample - Amount in sample)} \times 100}{\text{(R\%) (Known amount added)}}$

b. Precision = RPD = $\frac{\text{(Amount in Spike 1 - Amount in Spike 2)} \times 100}{0.5\ \text{(Amount in Spike 1 + Amount in Spike 2)}}$

c. Completeness = $\frac{\text{number of valid measurements obtained} \times 100}{\text{number of measurements planned}}$

NOTE: Refer to the definitions of accuracy, precision, and completeness in Section 3.0.

Corrective actions may be required for two classes of problems: analytical and equipment problems and noncompliance problems. Analytical and equipment problems may occur during sampling, sample handling, sample preparation, laboratory instrumental analysis, and data review.

For noncompliance problems, formal corrective action will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the O&M Contractor's Project Manager and Quality Assurance Officer (QAO) who will notify the U.S. EPA Remedial Project Manager and/or the U.S. EPA QAO. Implementation of corrective action will be confirmed in writing through the same channels.

Any non conformance with established quality control procedures in this QAPP will be identified and corrected in accordance with this QAPP. The O&M Contractor's QAO or designee will issue a Non conformance Report for each non conformance condition.

Corrective actions will be implemented and documented in the field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by the Group, the O&M Contractor's Project Manager, or the U.S. EPA Remedial Project Manager.

13.1 FIELD CORRECTIVE ACTION

Technical staff and project personnel will be responsible for reporting all suspected technical or QA non conformance or suspected deficiencies of any activity or used document by reporting the situation to the Field Manager or designee. This manager will be responsible for assessing the suspected problems in consultation with the O&M Contractor's QAO and Project Manager and making a decision based on the potential for the situation to impact the quality of the data. If the situation warrants a corrective action, then a non conformance report will be initiated by the Field Manager.

The Field Manager will be responsible for ensuring that corrective action for non conformances are initiated by:

- evaluating all reported non conformances
- controlling additional work on non conforming items
- determining disposition or action to be taken
- maintaining a log of non conformances
- reviewing non conformance reports and corrective actions taken
- ensuring non conformance reports are included in the final site documentation in project files

If appropriate, the Field Manager will ensure that no additional work that is dependent on the non conformance activity is performed until the corrective actions are completed.

Corrective action for field measures may include:

- repeat the measurement to check the error
- check for all proper adjustments for ambient conditions such as temperature
- check the batteries
- re-calibration
- replace the instrument or measurement devices
- stop work (if necessary)

The Field Manager is responsible for all site activities. In this role, the Field Manager at times is required to adjust procedures to accommodate site-specific needs.

Any change in procedures will be documented and signed by the initiators and the Field Manager. Each document will be numbered serially as required, and attached to the field copy of the affected document.

The Field Manager is responsible for the controlling, tracking, and implementation of the identified field changes. Reports on all changes will be distributed to all affected parties including the U.S. EPA. The O&M Contractor and U.S. EPA Remedial Project Manager will be notified whenever program changes in the field are made.

13.2 LABORATORY CORRECTIVE ACTION

Corrective action in the laboratory may occur prior to, during, and after initial analyses. A number of conditions such as broken samples containers, multiple phases, low/high pH readings, and potentially high concentration samples may be identified during sample log-in or just prior to analysis. Following consultation with lab analysts and section leaders, it may be necessary for Quanterra's Quality Assurance Officer to approve the implementation of corrective action. The submitted SOPs specify some conditions during or after analysis that may automatically trigger corrective action or optional procedures. These conditions may include dilution of samples, additional sample extract cleanup, automatic reinjection/reanalysis when certain quality control criteria are not met, etc. A summary of method-specific corrective actions are found in this QAPP.

The bench chemist will identify the need for corrective action. The Quanterra QAO in consultation with the Quanterra supervisor and staff, will approve the required corrective action to be implemented by the laboratory staff. The Quanterra QA manager will ensure implementation and documentation of the corrective action. If the non conformance causes project objectives not to be achieved, it will be necessary to inform all levels of project management including the U.S. EPA Remedial Project Manager to concur with the corrective action.

These corrective actions are performed prior to release of the data from the laboratory. The corrective action will be documented in both the Quanterra's corrective action log (signed by analyst, section leader and quality control coordinator), and the narrative data report sent from

Quanterra to the O&M Contractor's QAO. If corrective action does not rectify the situation, Quanterra will contact the U.S. EPA Remedial Project Manager.

13.3 CORRECTIVE ACTION DURING DATA VALIDATION AND DATA ASSESSMENT

The O&M Contractor's QAO may identify the need for corrective action during either the data validation or data assessment. Potential types of corrective action may include resampling by the field team or reinjection/reanalysis of samples by the laboratory.

These actions are dependent upon the ability to mobilize the field team and whether the data to be collected are necessary to meet the required quality assurance objectives. When the O&M Contractor's QAO (or designee) identifies a corrective action situation, it is the Group who will be responsible for approving the implementation of corrective action, including resampling, during data assessment. All corrective actions of this type will be documented by the Group and O&M Contractor's QAO.

The deliverables associated with the tasks identified in the PMP and monthly progress reports will contain separate QA sections in which data quality information collected during the task is summarized. Those reports will be the responsibility of the Group and will include the Group and O&M Contractor's Quality Assurance Officer reports on the accuracy, precision, and completeness of the data as well as the results of the performance and system audits, and any corrective action needed or taken during the project.

14.1 CONTENTS OF PROJECT QA REPORTS

The QA reports will contain on a routine basis all results of field and laboratory audits, all information generated during the past month reflecting on the achievement of specific data quality objectives, and a summary of corrective action that was implemented, and its immediate results on the project. The status of the project with respect to the Project Schedule will be reported. Whenever necessary, updates on training provided, changes in key personnel, anticipated problems in the field or lab for the coming month that could bear on data quality along with proposed solutions, will be reported. Detailed references to QAPP modifications will be reported. All QA reports will be prepared in written, final format by the Group or designee.

In the event of an emergency, or in case it is essential to implement corrective action immediately, QA reports can be made by telephone to the appropriate individuals, as identified in the Project Organization or Corrective Action sections of this QAPP. However, these events, and their resolution will be addressed thoroughly in the next issue of the monthly QA report.

14.2 FREQUENCY OF QA REPORTS

The QA Reports will be prepared on a monthly basis and will be delivered to all recipients by the 10th day of each month. The reports will continue without interruption, until the project is completed. The frequency of any emergency reports that must be delivered verbally cannot be estimated at the present time.

14.3 INDIVIDUALS RECEIVING/REVIEWING QA REPORTS

The following individuals outside of the Group will receive copies of the monthly QA report:

U.S. EPA	-	Jon Peterson
Project Coordinator	-	J. Seymour, Woodward Clyde Consultants
O&M Contractor	-	*Insert Name*, Project Manager
	-	*Insert Name*, QA Officer
	-	*Insert Name*, Field Manager
MDEQ	-	Kim Sakowski
Quanterra	-	Alesia Danford

United States Environmental Protection Agency, 1995, Unilateral Administrative Order, U.S. EPA Docket No. V-W-96-C-316.

United States Environmental Protection Agency Region V, 1996, Region 5 Model QA Project Plan, January 1996.

MDNR, 1990, Michigan Environmental Response Act - 1982 Public Act 307, as amended Administrative Rules, Michigan Department of Natural Resources Environmental Response Division.

MDNR, 1995, Environmental Response Division Operational Memorandum #6, Revision #4, September 13, 1995.

United States Environmental Protection Agency, 1986, RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, Washington D.C., September 1986, OSWER-9950.1.

United States Environmental Protection Agency, 1987a, Data Quality Objectives For Remedial Response Activities: Development Process, Washington D.C., March 1987, EPA 540/G-87/003.

United States Environmental Protection Agency, 1987b, Data Quality Objectives For Remedial Response Activities: Example Scenario RI/FS Activities at a Site With Contaminated Soil and Ground Water, Washington D.C., March 1987, EPA 540/G-87/004.

TestAmerica-Dayton Quality Assurance Manual

TestAmerica, Inc.
Dayton Division
Quality Assurance Plan
For
Routine Analytical Services

Approved By:

B. Chris Weathington
Division Manager

James A. Davis
Quality Assurance Coordinator

This is copy _____ of _____ prepared on _____.

2. TABLE OF CONTENTS

3. PROJECT DESCRIPTION

3.1 Introduction

This document describes the essential elements of the Quality Assurance Program at TestAmerica and the quality control procedures utilized by TestAmerica to ensure a national standard of quality.

3.2 Scope

TestAmerica believes that quality is the key to maintaining leadership in the environmental analytical industry.

The Quality Assurance (QA) program at TestAmerica requires that each division adhere to a division specific Quality Assurance Plan (QAP) which details the specific quality control procedures for that laboratory; and, as needed, project specific Quality Assurance Project Plans (QAPP).

3.2.1 TestAmerica subscribes to the following policies as its standard of quality in its analytical program:

- It is our policy to maintain a National Quality Assurance program throughout all TestAmerica laboratories, thereby providing our clients with defensible data of known and consistently high quality;

- It is our policy to communicate the scope and content of our QA Program internally to our employees and to train each employee in the application of our Program;

- It is our policy that no data will be reported to our clients that has not met our full QA requirements;

- It is our policy to remove from commercial offering any analysis offered by a TestAmerica laboratory when that laboratory fails to demonstrate that it can consistently perform that analysis to TestAmerica's high quality standard;

- It is our policy that any employee aware of misrepresentation of facts regarding analytical results is required to notify his/her immediate supervisor or, if this is not feasible, another representative of the management of the company immediately;

- It is our policy that all personnel be free from any undue internal and external pressures that may adversely affect the quality of their work, including but not necessarily limited to: commercial, client, production, operational and financial influences. Personnel

believing such pressures exist are required to immediately notify his/her supervisor or, if this is not feasible, another management representative as outlined in the Open Door Policy procedures found in the TestAmerica Human Resource Policy Manual;

- It is our policy to resolve complaints received from clients or other parties regarding the laboratory's activities. The complaint, including when data is questioned, is documented and resolved using the procedures outlined in Section 10. This includes the use of the Inter-Laboratory Notification form and/or the Re-Evaluation Request form. Additionally, the QA Coordinator determines if an audit of the specific activity is necessary;

- It is our policy to notify clients, in writing, when significant doubt is cast on the correctness or validity of data as a result of findings from an audit. The written documentation provides specific findings and conclusions and shall be made using either: the Inter-Laboratory Notification form from Section 10, a letter format, or the content of a Project Case Narrative.

4. PROJECT ORGANIZATION AND RESPONSIBILITY

4.1 Introduction

The success of this QA Plan requires the cooperative efforts and support of all personnel - Divisional and Corporate. The primary responsibility for data quality rests with the analyst in performing frequent and regular quality control checks on the work he/she does. This program is designed to support and coordinate these efforts at the bench level. The divisional organization structure is shown in Figure 4.1 and specific responsibilities related to quality assurance are as follows.

4.2 Assignment of Responsibilities

4.2.1 The Analyst shall:

- Adhere to analytical and QC protocols prescribed by approved SOPs and QAP/QAPPs;

- Review analytical data and quality control indicators on a daily basis.

- Correct out of control analyses if possible, otherwise, seek the Supervisor's help immediately;

- Meet sample hold times or immediately inform Supervisor if this is not possible;

- Perform routine maintenance on instruments and equipment;

- Maintain all sample tracking, preparation and instrument log books;

- Maintain control charts, as appropriate, to provide real-time trend analysis; - Document out of control situations and their resolution with corrective action reports; and

- Suggest improvements in methodologies to Supervisors and Quality Assurance personnel. These improvements, if approved, will be incorporated into SOPs.

4.2.2 The Supervisor (Operations Manager, etc.) shall:

- Provide training for new analysts using approved SOPs, verify adequacy of training and document the training;

- Ensure compliance with approved SOPs and QAP/QAPPs, including the quality control measures they prescribe;

- Investigate and assist the analyst in correcting an out of control analysis, and communicate the corrective action to the Division Manager and the QA Coordinator; - Guarantee that sample hold times are met or immediately notify the Division Manager and Customer Service Representative if this cannot be done;

- Assist in the development and revision of SOPs as needed, ensuring that they are: representative of how the procedure is done in the lab, method / technically correct, complete, and of sufficient detail to serve as a training document;

- Monitor control charting maintained by the analysts;

- Review, evaluate and approve data produced by analysts prior to reporting;

- Approve logbook entries for completeness and correctness and ensure that documentation is maintained securely and in an easily retrievable fashion; - Assist in the development and revision of the Divisional QAP;

- Serve as a Technical Manager or Deputy Technical Manager if so designated;

- Communicate to the Division Manager any needs for equipment and/or personnel in their area; and

- Communicate with other TestAmerica Supervisors with similar areas of responsibilities.

4.2.3 Division Quality Assurance Coordinator

The Division Quality Assurance Coordinator shall:

- Administer the Divisional QA Programs;

- Ensure that a Divisional QA Plan is in place that accurately reflects the QA/QC procedures of the laboratory, and coordinate the revision of the QAP as necessary;

- Assist in the development of SOPs as relates to quality control;

- Serve as the repository for the original copies of SOPs and the QAP and control the distribution of these documents;

- By conducting internal audits, ensure that SOPs are being followed; maintain a list of available SOPs;

- Assist in the writing of QA Project Plans (QAPPs), ensure that they are complete and accurate with regard to

regulatory requirements, and determine that the laboratory can meet the requirements set forth in the QAPP; maintain a copy of each QAPP;

- Assist in the coordination of PE samples for certification;

- Determine that analysts are properly trained in quality control measures for all analyses;

- Through internal audits, evaluate quality control processes and documentation throughout the laboratory, making recommendations for improvement when necessary;

- Assist the supervisors and analysts in the use of control charts to monitor analytical performance in the laboratory;

- Assist in interdivisional audits, as appropriate, and serve as QA support to Division Managers in external audits;

- Work closely with the Division Manager to resolve data quality related issues;

- Communicate to the Division Manager areas requiring corrective action and help define appropriate corrective action. Determine that the corrective action has been properly carried out and documented;

- Assist the Division Manager in obtaining and maintaining needed certifications, performance evaluation samples and contract laboratory status;

- Serve as a repository for all audit and performance evaluation results and for certification and licensing documentation;

- Serve as a Technical Manager or Deputy Technical Manager if so designated;

- Communicate with other TestAmerica QA Coordinators; and

- Prepare a monthly QA report and submit to the Division Manager.

THE DIVISION QUALITY ASSURANCE COORDINATOR WILL NOT:

- Participate in any operational activities involving the production of analytical data or reports. Specifically, his/her responsibilities will not include sample collection, sample receipt or log-in, preparation or analysis of samples, supervision of analytical sections or departments, routine data review, preparation of

reports, project management, or management of a division.

- Sign analytical reports or data packages to external customers (unless mandated by specific State requirements).

4.2.4 The Technical Manager(s) (however named) shall:

- Be designated by the Division Manager;

- Be technically competent in their area of responsibility;

- Have overall technical responsibility for the designated technical operations;

- Provide technical guidance to the analytical staff and be the source point for technical help; and

- Normally hold the position of an Operations Manager or Supervisor but may be a senior analyst in a given department who is readily available to provide technical assistance. There may be more than one Technical Manager, i.e., organic inorganic or departmental, so long as they are properly identified and designated. The Division Manager or QA Coordinator may be a Technical Manager.

4.2.5 The Deputy Technical Manager(s) (however named) shall:

- Be nominated by the Division Manager;

- In the temporary absence of the Technical Manager, assume responsibilities for this function;

- Normally hold the position of an Operations Manager (i.e., Inorganic Operations Manager and Organic Operations Manager can serve as each others Deputy), or Supervisor but may be a senior analyst in a given department who is readily available to provide technical assistance. There may be more than one Deputy Technical Manager so long as they are properly identified and designated. The Division Manager or QA Coordinator may be a Deputy Technical Manager.

4.2.6 The Division Manager shall:

- In the temporary absence of a Division QA Coordinator, assume all responsibilities of the Division QA Coordinator position;

- Ensure that the operational requirements of this Plan and supporting programs are met;

- Manage the on-going requirements of Quality Assurance and Quality Control activities through Supervisors and Division QA Coordinators;

- Approve and implement SOPs, QAPs and QAPPs;

- Ensure that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal or external performance or procedural audits;

- Review and submit corrective action reports;

- Have in place a system to ensure that sample holding times are met. Notify the client whenever hold times are missed;

- Ensure that all analysts and supervisors have received adequate training to properly carry out the duties assigned to them and document this training;

- Pursue and maintain appropriate laboratory certification and contract approvals. Arrange for the analysis of Performance Evaluation (PE) samples necessary to satisfy certification requirements;

- Serve as a Technical Manager or Deputy Technical Manager if so designated;

- With the help of the Client Service Representative or the Project Manager, ensure that analysts and supervisors know any client specific reporting and QC requirements prior to sample arrival in the lab; and

- Represent, or designate an alternate individual to represent the Division during client and/or regulatory audits, with QA support as needed from Division and/or Corporate QA personnel.

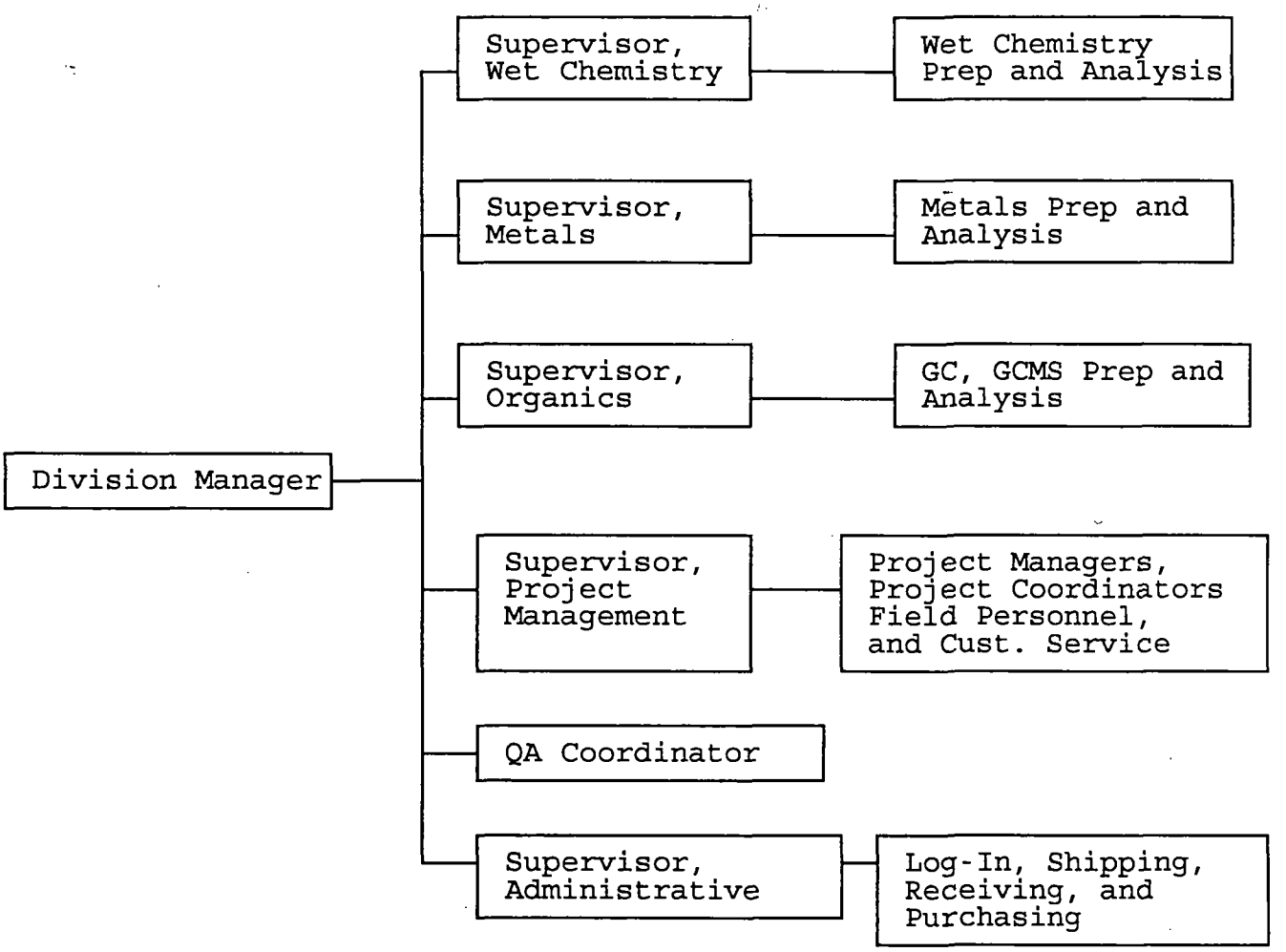
4.3 Communications

The TestAmerica Corporate office supports an "open door" communications policy: every TestAmerica employee has free access to the Corporate office. Additionally, this Plan supports using resources (people in particular) at all levels; appropriate, frequent, effective communication is encouraged throughout TestAmerica. In addition, specific documents relating to this Plan are available to all employees, including:

Quality Assurance Programs to address specific areas identified in this Plan. Programs exist for SOPs, QAPs, and the Data Quality Audits and these have been incorporated into this Plan.

Quality Assurance Policies to address specific quality related items outside the scope of existing Programs.

Figure 4.1. Organization of TestAmerica, Inc. Dayton Division.



5. QUALITY ASSURANCE OBJECTIVES

5.1 Introduction

The quality assurance objectives are to provide analytical data of known and documented quality, to produce defensible analytical data and to produce data which meets the client's specific needs for the data in a cost effective manner.

Data quality is defined in terms of data quality objectives. Data quality objectives are the qualitative and quantitative statements which specify the required data quality based on the end use of the data to be collected. Data quality is assessed by precision, accuracy, representativeness and comparability.

5.1.1 To accomplish its data quality objectives, TestAmerica Dayton will:

- Maintain an effective, on-going Quality Assurance and Quality Control Program that measures and verifies laboratory performance;

- Provide sufficient flexibility to allow controlled changes in routine methodology to meet project specific data requirements;

- Recognize as soon as possible and provide correction for any factors which may adversely affect data quality;

- Monitor operational performance of the laboratory on a routine basis and provide corrective action as needed;

- Maintain complete records of sample submittal, raw data, laboratory performance and complete analysis to support reported data.

5.2 Level of Quality Control and Quality Assurance Efforts

TestAmerica maintains a well defined internal quality control (QC) program. A system of specific activities are in use in the laboratory to ensure that the analytical data generated is of consistently high quality. Blanks, Calibration Verification Standards, Laboratory Control Samples, Spikes, Duplicates and Matrix Spikes are analyzed and monitored at regular frequencies, to ensure that the data quality objectives for the project are met.

5.3 Accuracy

Accuracy is defined as how close an analytical value is to the actual concentration of analyte in the sample. Accuracy is evaluated through the analysis of Laboratory Control Samples

(LCS). Matrix Spikes may also be used to assess accuracy. Accuracy goals are outlined in Table 5.1 through 5.11.

5.4 Precision

Precision is defined as the repeatability of a measurement. It is an indication of the variability of a measurement. Precision is evaluated through the use of matrix spike/matrix spike duplicates (MS/MSD) or through duplicate analysis when matrix spiking is not possible. Precision is expressed in terms of relative percent difference (RPD). Precision goals are outlined in Table 5.1 through 5.11.

5.5 Completeness

Completeness is defined as the measure of the amount of valid data, as determined utilizing the quality assurance and the associated standard operating procedures, obtained from the analytical measurement system compared to the amount of valid data that was expected to be obtained under correct operating conditions. Completeness is expressed as a percentage of the number of data with acceptable results divided by the number of expected results.

Completeness will be determined by the client. Ideally, all of the analyses will be valid. However, some samples may be lost in laboratory accidents or some results may be deemed questionable based on internal quality control. TestAmerica will make every effort to produce analytical data that meets the completeness requirements of the client.

5.6 Representativeness

Representativeness is a measure of how closely the analytical results reflect the actual concentration of analytes in the sample. For any project, sampling will be performed by the customer or the customer's representative (the customer may contract with TestAmerica for sampling services). Sample handling protocols (i.e., storage and preservation) have been developed to preserve the representativeness of the collected samples.

Every attempt will be made to ensure that the aliquots taken for analysis are representative of the sample received. TestAmerica will notify the client if samples received in the laboratory have any of the following conditions: improper preservation, broken sample containers, chain of custody discrepancies, broken or missing custody seals (if required) and TestAmerica will document such deviations. All other measures of representativeness will be determined by the client.

5.7 Comparability

The generation of comparable data is the goal of any analytical program. This characteristic implies strict adherence to published analytical protocols and use of standard reporting units. TestAmerica's QC program is structured to ensure adherence to the proper analysis protocols and fully document these procedures. The QA objective is that all data resulting from these analyses be comparable with other measurements made by TestAmerica or another organization. All judgements of comparability will be made by the client.

5.8 Quality Control Measures

The following tables summarize the Quality Control Indicators (QCIs) which are performed with the common analytical procedures at TestAmerica-Dayton. The tables are for general reference, as method specific criteria varies. Please refer to the Standard Operating Procedures (SOPs) for specific control limit information.

Table 5.1. Quality Control Measures for Wet Chemistry

Quality Control Measure	Frequency	Control Limits
Calibration Curve	*	Correlation Coef. ≥ 0.995
Initial Calibration Verification (ICV)	1 / Calibration	Accuracy 90 - 110 %
Reagent Blank	Daily	< Reporting Limit
Method Blank	1 / 20 samples	< Reporting Limit
Continuing Calibration Verification (CCV)	Beginning & end of run; 1 / 10 samples	**
Laboratory Control Sample (LCS)	1 / batch	**
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	1 / batch	**
Duplicate	1 / batch if parameters cannot be spiked	**

* If calibrations are applicable to a Wet Chemistry parameter, they will be performed on a daily basis, or at the frequency specified in the SOP.

** The control limits for these Quality Control Indicators are statistically determined annually based on +/- 3 standard deviations from the mean. Control limits can not exceed the range listed in the method.

Table 5.2. Quality Control Measures for Bacterial Analyses

Fecal Coliform

Quality Control Measure	Frequency	Control Limits
Media pH Control	Weekly	+/- 0.2 pH Units
Filtration Blanks	Daily	< 1 Colony

Total Coliform

Quality Control Measure	Frequency	Control Limits
Media Quality Check	1/ Media Batch	E. Coli + Klebsiella + Pseudomonas -
Positive control	1/ Sample Set	Positive Coliform
Negative control	1/ Sample Set	Negative Coliform
Sample bottle sterility check	3/ box of sample bottles	Negative Coliform

Table 5.3. Quality Control Measures for Metals Graphite Furnace

Quality Control Measure	Frequency	Control Limits
Calibration Curve	Daily	Correlation Coef. ≥ 0.995
Initial Calibration Verification (ICV)	Daily	Accuracy 90 - 110 %
Reagent Blank	Daily	< Reporting Limit
Method Blank	1 / Batch	< Reporting Limit
Continuing Calibration Verification	Beginning & end of run 1 / 10 samples	Accuracy 90 - 110 %
Laboratory Control Sample (LCS)	1 / Batch	80 % - 120 %
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	1 / Batch	75 % - 125 %

Table 5.4. Quality Control Measures for Metals by Inductively Coupled Plasma Atomic Emission (ICP-AES)

Quality Control Measure	Frequency	Control Limits
Calibration Curve	Daily	% RSD of three readings <10.5%
Re-analyze Calibration Standards	Daily	Accuracy 95 - 105 %
Initial Calibration Verification (ICV)	Daily	Accuracy 90 - 110 %
Reagent Blank	1 / 10 Samples	< Reporting Limit
Reporting Limit Verification (RLV)	Daily	Accuracy 70 - 130 %
Spectral Interference Checks (SIC)	Beginning & end of run	Per Method**
Continuing Calibration Verification (CCV)	Beginning & end of run; 1 / 10 Samples	Accuracy 90 - 110 %
Method Blanks	1 / Batch	< Reporting Limit
Laboratory Control Samples (LCS)	1 / Batch	85 % - 115 %
Matrix Spike/ Matrix Spike Duplicates	1 / Batch	75 % - 125 %

** Please refer to the SOP for Method specific criteria.

Table 5.5. Quality Control Measures for Metals by Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)

US EPA Method 200.8

Quality Control Measure	Frequency	Control Limits
Calibration Blank	Daily	
Calibration Curve	Daily	
Initial Calibration Verification (ICV)	Daily	Accuracy 90 - 110 %
Continuing Calibration Blank	Beginning & end of run 1 / 10 Samples	< 1/10 Reporting Limit or 2.2x the MDL, which ever is greater
Reporting Limit Verification (RLV)	Daily	Accuracy 70 - 130 %
Continuing Calibration Verification (CCV)	Beginning & end of run; 1 / 10 Samples	Accuracy 90 - 110 %
Reagent Blank	1 / Batch	< 1/10 Reporting Limit or 2.2x the MDL, which ever is greater
Laboratory Control Samples (LCS)	1 / Batch	85 % - 115 %
Matrix Spike/ Matrix Spike Duplicates (MS/MSD)	1 pair / Batch	75 % - 125 %
Internal Standard	All	Accuracy 60 - 125 % of Initial Cal. Blank
Mass Calibration and Resolution Check	Daily	Per Method**
Instrument Stability	Daily	Per Method**

NOTE: Rinse Blanks are used after each Quality Control or client sample.

** Please refer to the SOP for Method specific criteria.

Table 5.6. Quality Control Measures for Metals by Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)

SW 846 Method 6020

Quality Control Measure	Frequency	Control Limits
Calibration Blank	Daily	
Calibration Curve	Daily	
Initial Calibration Verification (ICV)	Daily	Accuracy 90 - 110 %
Continuing Calibration Blank	Beginning & end of run; 1 / 10 Samples	< Reporting Limit
Reporting Limit Verification (RLV)	Daily	Accuracy 70 - 130 %
Continuing Calibration Verification (CCV)	Beginning & end of run; 1 / 10 Samples	Accuracy 90 - 110 %
Reagent Blank	1 / Batch	< Reporting Limit
Laboratory Control Samples (LCS)	1 / Batch	85 % - 115 %
Matrix Spike/ Matrix Spike Duplicates (MS/MSD)	1 / Batch	75 % - 125 %
Internal Standard	All	- Accuracy 30 - 120 % of Initial Cal. Blank for samples - Accuracy 80 - 120 % of Initial Cal. Blank for Quality Control samples
Mass Calibration and Resolution Check	Daily	Per Method**
Instrument Stability	Daily	Per Method**
Interference Check Sample	Beginning & end of run	Per Method**

NOTE: Rinse blanks are used after each Quality Control or client sample.

** Please refer to the SOP for Method specific criteria.

Table 5.7. Quality Control Measures for Mercury by Cold Vapor

Quality Control Measure	Frequency	Control Limits
Calibration Curve	Daily	Correlation Coef. ≥ 0.995
Initial Calibration Verification (ICV)	Daily	Accuracy 90 - 110 %
Reagent Blank	Daily	< Reporting Limit
Method Blank	1 / Batch	< Reporting Limit
Continuing Calibration Verification	Beginning & end of run 1 / 10 samples	Accuracy 80 - 120 %
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	1 / Batch	75 % - 125 %

Table 5.8. Quality Control Measures for Volatiles by GC/MS

US EPA Method 624

Quality Control Measure	Frequency	Control Limits
Initial Calibration	*	Minimum of 3 Standards < 35% RSD
Initial Calibration Verification (ICV)	1 / Calibration	± 30 % of True Value
Tune Check	1 / 12 hours	Per Method**
Continuing Calibration Verification (CCV)	1 / 12 hours	Per Method**
Surrogates/Internal Standards	All	Per Method**
Method Blanks	1 / 12 hours	< Reporting Limit
Matrix Spike/ Laboratory Control Standards	1 / 20 samples	Per Method**

* An initial calibration is required whenever the Quality Control Indicators do not pass established acceptance criteria.
** Please refer to the SOP for Method specific criteria.

SW 846 8260A

Quality Control Measure	Frequency	Control Limits
Initial Calibration	*	Minimum of 5 Standards SPCC/CCC per Method**
Initial Calibration Verification (ICV)	1 / Calibration	± 30 % of True Value
Tune Check	1 / 12 hours	Per Method**
Continuing Calibration Verification (CCV)	1 / 12 hours	SPCC/CCC per Method**
Surrogates/Internal Standards	All	Per Method**
Method Blanks	1 / 12 hours	< Reporting Limit
Matrix Spike/ Matrix Spike Duplicate & Laboratory Control Standard	1 / 20 Samples and/or daily	Per Method**

Table 5.8. Continued...

US EPA Method 524.2

Quality Control Measure	Frequency	Control Limits
Initial Calibration	*	Minimum of 4 standards < 20 % RSD
Initial Calibration Verification (ICV)	1 / Calibration	± 40 % of True Value
Tune Check	1 / 12 hours	Per Method**
Reporting Limit Verification Standard	1 / 12 hours	± 40 % of True Value
Continuing Calibration Verification (CCV)	1 / 12 hours up to 20 samples	< 30 % RSD
Surrogates/Internal Standards	All	Per Method**
Reagent Blank	1 / 12 Hours	< Reporting Limit

* An initial calibration is required whenever the Quality Control Indicators do not pass established acceptance criteria.
** Please refer to the SOP for Method specific criteria.

Table 5.9. Quality Control Measures for Semi-volatiles by GC/MS

SW 846 8270B

Quality Control Measure	Frequency	Control Limits
Initial Calibration	*	Minimum of 5 Standards < 30 % RSD
Initial Calibration Verification (ICV)	1 / Calibration	± 30 % of True Value
Tune Check	1 / 12 hours	Per Method**
Continuing Calibration Verification (CCV)	1 / 12 hours	SPCC/CCC per Method**
Surrogates/Internal Standards	All	Per Method**
Method Blanks	1 / Extraction Set	< Reporting Limit
Matrix Spike/ Matrix Spike Duplicate	1 / 20 Samples	Per Method**
Laboratory Control Standard	1 / Extraction Set	Per Method**

US EPA Method 625

Quality Control Measure	Frequency	Control Limits
Initial Calibration	*	Minimum of 3 Standards < 35 % RSD
Initial Calibration Verification (ICV)	1 / Calibration	± 30 % of True Value
Tune Check	1 / 12 hours	Per Method**
Continuing Calibration Verification (CCV)	1 / 12 hours	Per Method**
Surrogates/Internal Standards	All	Per Method**
Method Blanks	1 / Extraction Set	< Reporting Limit
Laboratory Control Standard	1 / Extraction Set	Per Method**
Matrix Spike/ Matrix Spike Duplicate	1 / 20 Samples	Per Method**

Table 5.9. Continued...

* An intial calibration is required whenever the Quality Control Indicators do not pass established acceptance criteria.

** Please refer to the SOP for Method specific criteria.

Table 5.10. Quality Control Measures for Pesticides/PCBs

SW 846 8080A

Quality Control Measure	Frequency	Control Limits
Initial Calibration	*	Minimum of 5 Standards < 20 % RSD
Initial Calibration Verification (ICV)	1 / Calibration	± 30 % of True Value
Continuing Calibration Verification (CCV)	Beginning & end of run; 1 / 10 samples	Per Method**
Method Blank	1 / Extraction Set	< Reporting Limit
Surrogates	All	Per Method**
Laboratory Control Sample (LCS)	1 / Extraction Set	Per Method**
Matrix Spike/ Matrix Spike Duplicate	1 / 20 Samples	Per Method**

US EPA Method 608

Quality Control Measure	Frequency	Control Limits
Initial Calibration	*	Minimum of 3 Standards < 10 % RSD
Initial Calibration Verification (ICV)	1 / Calibration	± 30 % of True Value
Continuing Calibration Verification (CCV)	Beginning & end of run; 1 / 10 samples	< 15 % Difference
Method Blank	1 / Extraction Set	< Reporting Limit
Surrogates	All	Per Method**
Laboratory Control Sample (LCS)	1 / Extraction Set	Per Method**
Matrix Spike/ Matrix Spike Duplicate	1 / 20 Samples	Per Method**

* An initial calibration is required whenever the Quality Control Indicators do not pass established acceptance criteria.
** Please refer to the SOP for Method specific criteria.

Table 5.11. Quality Control Measures for Total Petroleum Hydrocarbons (TPH) by FTIR

US EPA Method 418.1

Quality Control Measure	Frequency	Control Limits
Initial Calibration	*, Daily for Voluntary Action Program	Min. of 3 standards Correlation Coef. ≥ 0.995
Initial Calibration Verification (ICV)	1 / Calibration	Accuracy 90 - 110%
Reagent Blank	Daily	< Reporting Limit
Method Blank	1 / Extraction Set	< Reporting Limit
Continuing Calibration Verification (CCV)	1 / 10 Samples	**
Laboratory Control Samples (LCS)	1 / Extraction Set	**
Matrix Spike/ Matrix Spike Duplicate	1 / 20 Samples	**

* An initial calibration is required whenever the Quality Control Indicators do not pass established acceptance criteria.

** The control limits for these Quality Control Indicators are statistically determined annually based on +/- 3 standard deviations from the mean. Control limits can not exceed the range listed in the method.

Table 5.12. Quality Control Measures for Total Petroleum Hydrocarbons (Diesel Range Organics)

SW-846 8015B

Quality Control Measure	Frequency	Control Limits
Initial Calibration	*	Min. of 5 standards % RSD < 20% or Correlation Coef. ≥ 0.995
Reagent Blank	Daily	< Reporting Limit
Method Blank	1 / Extraction Set	< Reporting Limit
Continuing Calibration Verification (CCV)	1 / 20 Samples up to 12 hours	< 15 % Difference
Laboratory Control Samples (LCS)	1 / Extraction Set	**
Matrix Spike/ Matrix Spike Duplicate	1 / 20 Samples	**
Surrogate	1 / Sample	**

* An initial calibration is required whenever the Quality Control Indicators do not pass established acceptance criteria.

** The control limits for these Quality Control Indicators are statistically determined annually based on +/- 3 standard deviations from the mean. Control limits can not exceed the range listed in the method.

Table 5.13. Quality Control Measures for Total Petroleum Hydrocarbons (Gasoline Range Organics)

SW-846 8015A Modified

Quality Control Measure	Frequency	Control Limits
Initial Calibration	*	Min. of 5 standards % RSD < 20% or Correlation Coef. ≥ 0.99
Reagent Blank	Daily	< Reporting Limit
Continuing Calibration Verification (CCV)	1 / 10 Samples	< 15 % Difference
Laboratory Control Samples (LCS)	1 / Batch up to 20 samples	**
Matrix Spike/ Matrix Spike Duplicate	1 pair / Batch up to 20 samples	**
Surrogates	All Samples/Standards	**

* An initial calibration is required whenever the Quality Control Indicators do not pass established acceptance criteria.

** The control limits for these Quality Control Indicators are statistically determined annually based on +/- 3 standard deviations from the mean. Control limits can not exceed the range listed in the method.

Table 5.14. Quality Control Measures for Total Petroleum Hydrocarbons (Gasoline Range Organics)

SW-846 8015B

Quality Control Measure	Frequency	Control Limits
Initial Calibration	*	Min. of 5 standards % RSD < 20% or Correlation Coef. ≥-0.99
Reagent Blank	Daily	< Reporting Limit
Continuing Calibration Verification (CCV)	1 / 20 Samples up to 12 hours	< 15 % Difference
Laboratory Control Samples (LCS)	1 / Batch up to 20 samples	**
Matrix Spike/ Matrix Spike Duplicate	1 pair / Batch up to 20 samples	**
Surrogates	All Samples/Standards	**

* An initial calibration is required whenever the Quality Control Indicators do not pass established acceptance criteria.

** The control limits for these Quality Control Indicators are statistically determined annually based on +/- 3 standard deviations from the mean. Control limits can not exceed the range listed in the method.

Table 5.15. Quality Control Measures for BTEX

SW-846 8020A

Quality Control Measure	Frequency	Control Limits
Initial Calibration	*	Min. of 5 standards % RSD < 20% or Correlation Coef. ≥ 0.99
Reagent Blank	Daily	< Reporting Limit
Continuing Calibration Verification (CCV)	1 / 10 Samples	< 15 % Difference
Laboratory Control Samples (LCS)	1 / Batch up to 20 samples	**
Matrix Spike/ Matrix Spike Duplicate	1 pair / Batch up to 20 samples	**
Surrogates	All Samples/Standards	**

* An initial calibration is required whenever the Quality Control Indicators do not pass established acceptance criteria.

** The control limits for these Quality Control Indicators are statistically determined annually based on +/- 3 standard deviations from the mean. Control limits can not exceed the range listed in the method.

Table 5.16. Quality Control Measures for BTEX

SW-846 8021B

Quality Control Measure	Frequency	Control Limits
Initial Calibration	*	Min. of 5 standards % RSD < 20% or Correlation Coef. ≥ 0.99
Reagent Blank	Daily	< Reporting Limit
Continuing Calibration Verification (CCV)	1 / 20 Samples up to 12 hours	< 15 % Difference
Laboratory Control Samples (LCS)	1 / Batch up to 20 samples	**
Matrix Spike/ Matrix Spike Duplicate	1 pair / Batch up to 20 samples	**
Surrogates	All Samples/Standards	**

* An initial calibration is required whenever the Quality Control Indicators do not pass established acceptance criteria.

** The control limits for these Quality Control Indicators are statistically determined annually based on +/- 3 standard deviations from the mean. Control limits can not exceed the range listed in the method.

Table 5.17. Polynuclear Aromatic Hydrocarbons by HPLC

SW-846 8310

Quality Control Measure	Frequency	Control Limits
Initial Calibration	*	Min. of 5 standards % RSD < 20% or Correlation Coef. ≥ 0.99
Reagent Blank	Daily	< Reporting Limit
Method Blank	1 / Extraction Set	< Reporting Limit
Continuing Calibration Verification (CCV)	1 / 20 Samples up to 12 hours	< 15 % Difference
Laboratory Control Samples (LCS)	1 / Extraction Set	**
Matrix Spike/ Matrix Spike Duplicate	1 / 20 Samples	**
Surrogate	1 / Sample	**

* An initial calibration is required whenever the Quality Control Indicators do not pass established acceptance criteria.

** The control limits for these Quality Control Indicators are statistically determined annually based on +/- 3 standard deviations from the mean. Control limits can not exceed the range listed in the method.

Table 5.18. Quality Control Measures for Radiological Parameters

Quality Control Measure	Frequency	Control Limits
Calibration of Efficiency Factor	Annually	NA
Method Blank	1 / 20 Samples	< Reporting Limit
Continuing Calibration Verification (CCV)	Daily	*
Laboratory Control Samples (LCS)	1 / 20 Samples	*
Matrix Spike / Matrix Spike Duplicates	1 / 20 Samples	*

* The control limits for these Quality Control Indicators are statistically determined annually based on +/- 3 standard deviations from the mean.

6. SAMPLING PROCEDURES

Often, field sampling is the most critical aspect of an analysis. To ensure the reliability of the data, quality control measures are included in all field sampling activities completed by TestAmerica personnel. Result validity is aided by proper sampling, handling and identification of samples through detailed chain-of-custody procedures.

6.1 Sampling

The sampling site is chosen by the client. Sampling points are documented as to their exact location for purposes of future sampling.

TestAmerica provides sample media, containers and preservatives as outlined in Table 6.1, as well as shipping containers (coolers) for any project accepted by TestAmerica. A chain of custody record will be provided with each set of sample containers supplied. Chain of custody records are described in more detail in Section 7 of this document.

All field sampling equipment used by TestAmerica is thoroughly cleaned with lab detergent and water and a stiff brush. Field sampling equipment is decontaminated between samples in the field.

When sampling is performed by TestAmerica, background information is gathered to determine if any safety risks are involved in sampling. This background information is also used to make decisions on what type of sampler to use, type of sample container to use and number of samples to take.

6.2 Sample Types

6.2.1 The two most common types of field samples are the grab sample and the composite sample. The definitions of grab and composite samples are as follows:

> **Grab** A discrete aliquot that is representative of one specific sample site, at a specific point in time. The entire sample is collected at one point and all at one time.
>
> **Composite** A sample composed of more than one specific aliquot collected at various sites and/or at different points in time.

6.2.2 Blanks can also be collected during the sampling process. The three main types of blanks associated with sampling are the field blank, the trip blank and the equipment blank.

The definitions of the various types of blanks are as follows:

Field Blank A field blank is an aliquot of analyte-free water that is brought to the field site in a sealed sample container, poured into the appropriate sample containers and transported back to the laboratory. Field blanks are used to determine previously existing container or preservative contamination, and/or contamination that may have resulted from existing field conditions when samples were collected.

Equipment Blank A sample of analyte free water that is poured appropriately over or through the sampling device, containerized, preserved (if the samples are preserved) and handled in the same manner as the samples. The equipment blank is used to identify sample contamination (if any) acquired through collection, handling, preservation and transport.

Trip Blank A sample of analyte-free water which is taken before the sampling event has begun. The trip blank travels with the sample containers as they are shipped to the field site and as the samples are sent back to the laboratory. The trip blank is not opened in the field. It is used to identify contamination or cross contamination due to location or shipping conditions.

All sample types should be maintained during shipment at 4 degrees Celsius. Table 6.1 lists common sample containers and preservatives.

6.3 Subcontracted Analyses

The laboratory will endeavor to inform clients prior to subcontracting analyses to other laboratories. When this subcontracting is routine, the client will be informed by letter or by notation on the sample bottle order included in all bottle shipments. Data from subcontracted analyses are flagged on the analytical data reports.

Table 6.1. General Guidelines for Samples

Parameter	Container	Preservative	Volume	Hold Time
General Chemistry				
Acidity	P,G	4°C	100	14 days
Alkalinity	P,G	4°C	100	14 days
BOD/CBOD	P,G	4°C	1000	48 hours
Chloride	P,G	None	100	28 days
Chlorine	P,G	None	200	On site
COD	P,G	4°C,H2SO4, pH <2	100	28 days
Color	P,G	4°C	50	48 hours
Cyanide, Amenable	P,G	4°C,NaOH, pH >12	1000	14 days
Cyanide, Total	P,G	4°C,NaOH, pH >12	1000	14 days
Fluoride, Total	P	None	300	28 days
Hardness	P,G	4°C,HNO3, pH <2	100	6 months
Ignitability	G	None	100	
Nitrogen, Ammonia	P,G	4°C,H2SO4, pH <2	400	28 days
Nitrogen, Kjeldahl	P,G	4°C,H2SO4, pH<2	500	28 days
Nitrogen, Nitrite	P,G	4°C	100	48 hours
Nitrogen, Nitrate & Nitrite	P,G	4°C,H2SO4, pH <2	100	28 days

Table 6.1 Continued...

Parameter	Container	Preservative	Volume	Hold Time
Oil & Grease	G	4°C,H2SO4, pH <2	1000	28 days
Paint Filter, Liquids	G	None	250	NA
pH	P,G	None	25	On Site
Phenols	G	4°C,H2SO4, pH <2	500	28 days
Phosphorus, Ortho	P,G	4°C	100	48 hours
Phosphorus, Total	P,G	4°C,H2SO4, pH <2	100	28 days
Residue, Filterable (TDS)	P,G	4°C	500	7 days
Residue, Non-Filterable (TSS)	P,G	4°C	500	7 days
Residue, Settleable (SS)	P,G	4°C	1000	7 days
Residue, Total (TS)	P,G	4°C	500	7 days
Residue, Volatile (TVS)	P,G	4°C	500	7 days
Specific Conductance	P,G	4°C	100	28 days
Sulfate	P,G	4°C	100	28 days
Sulfide	P,G	4°C,NaOH,ZnAc, pH >9	500	7 days
Sulfite	P,G	None	100	on site
Surfactants (MBAS)	P,G	4°C	250	48 hours
Total Organic Carbon (TOC)	P,G	4°C,H2SO4, pH <2	250	28 days
Turbidity	P,G	4°C	100	2 days
Bacteria				
Coliform, Fecal	P sterile	None	100	6 hours
Coliform, Total and E. Coli	P sterile	None	100	30 hours

Table 6.1 Continued...

Parameter	Container	Preservative	Volume	Hold Time
Metals				
Chromium, Hexavalent	P	4°C	500	24 Hours
Mercury	P	HNO3, pH <2	250	28 Days
All Other Metals	P	HNO3, pH <2	250	6 months
TCLP	G	4°C	1000 g	14 days
Radiological				
Alpha/Beta	P	HNO_3, pH <2	1000	6 months
Organics				
Volatile Organics **	G Vials	4°C,HCl, pH <2 *	40 (x3)	14 days
Pesticides/PCB's	G	4°C *	1000	7 days
Pesticides	G	4°C *	1000	7 days
Extractable Organics	G	4°C *	1000	7 days
PNAs	G	4°C *	1000	7 days
TPH (418.1, DRO)	G	4°C,HCl, pH <2 *	1000	7 days
TPH (GRO) **	G	4°C,HCl, pH <2 *	40 (x3)	14 days
Petroleum Hydrocarbons	G	4°C	1000	7 days
Hydrocarbon Solvents	G	4°C	25	NA
PCB in Oils	G Vial	None	2	NA
TCLP	G	4°C	1000 g	14 days

* NOTE: Chlorinated water sources must first be dechlorinated.

** Soil samples for SW-5035 are collected in triplicate with Encore samplers and preserved at the laboratory within 48 hours with sodium bisulfate and/or methanol. If field preservation is required, two vials with sodium bisulfate and one vial with 5 mL of Methanol are provided for collecting soil samples.

Solids and soils are collected in wide mouth glass jars which have Teflon-lined lids. Samples are maintained at 4°C, if required.

7. SAMPLE CUSTODY

Correct sample handling procedures are an integral part of the Quality Assurance program for TestAmerica. A chain of custody documents the sample identity, number of samples, requested analyses and the custody of samples.

7.1 Chain of Custody Procedures

Chain of Custody forms are utilized to document, in a legally defensible manner, the transfer of custody for each sample. TestAmerica will follow the descriptions and requested analyses outlined on the Chain of Custody provided by the client. TestAmerica **strongly** recommends that the chain of custody (COC) be completed and sent with the samples to the lab for analysis. Failure to submit a COC may result in delays for laboratory analysis and possible legal problems if the site evaluation comes into question at a later date.

When samples arrive at TestAmerica, the Sample Custodian documents the condition of custody seals on the Chain of Custody. The temperature of the cooler is documented. The sample custodian checks the sample label against the chain of custody, and notes any deviations. In cases where there are discrepancies between the samples received and the COC, or when samples are received damaged, incorrectly preserved or missing, TestAmerica will notify the client and require that any changes be submitted to TestAmerica in writing.

Samples are then logged into TestAmerica's Laboratory Information Management System (LIMS) and are assigned a unique sample identification number and the requested analyses are linked to the identification number.

Samples that require temperature preservation are maintained at approximately 4 degrees Celsius in a designated sample storage area until the time of analysis and are returned to this area when not in the custody of an analyst.

7.2 Laboratory Document Control

All documentation in logbooks and other pertinent documents are entered in ink. Corrections made to data are performed in accordance with EPA Guidelines.

All raw data and pertinent records are maintained for a period of 7 years for non-potable data and 10 years for potable data. As part of the Voluntary Action Program (VAP) requirements, all documents prepared or acquired in connection with a voluntary action will be retained for a period of ten years from the date the analyses were submitted to a certified professional.

8. CALIBRATION PROCEDURES AND FREQUENCY

This section describes the calibration procedures and frequency for the instrumentation which will be used in the determination of the parameters of interest.

8.1 Laboratory Standards

All materials used for instrument calibration, internal standards and surrogate standards will be of the highest purity available from a commercial source. All standards will have a minimum purity of 96%. The calibration procedures outlined here are those routinely used in the laboratory. The calibration frequencies are listed in the Tables in Section 5.

8.2 Standards Traceability

All materials, whether high purity bulk material or prepared solutions, will have the following information, at a minimum, recorded into an analytical standards logbook: identity, supplier, lot number, date received, reported concentration and expiration data. This information will be recorded when the material is received or no later than the first time the material is opened.

All analytical standards and spiking solutions will have a unique identification consisting of a name, concentration, expiration date, logbook reference number and the preparation or received date. This identification will be clearly recorded on the label of any bottle containing this material. By consistently using this identification on raw data, the solution can be traced back to the original material.

Documentation of all standard preparations will be recorded in logbooks. The volume and numerical reference of all analytical standards or spiking solutions used in the preparation of another standard will be recorded in the standard preparation logbook.

All calibration standards must be verified against an independently prepared standard from a second manufacturer or a different lot from the same manufacturer.

8.3 Instrument Calibration

Instrument calibration is described in detail in the method specific Standard Operating Procedures. Please refer to the SOPS for additional information concerning calibration and the associated Quality Control Indicators.

8.4. Analytical Balances

Analytical balance calibration is verified on a monthly and daily basis with NBS traceable class S weights. The calibration of each analytical balance is checked on a daily basis by the use of two weights, one in the milligram range and one in the gram range, to determine if the calibration is still valid. A more thorough validation is done on a monthly basis with four weights. All analytical balances receive yearly system checks and calibrations from certified technicians.

8.5. Non-analytical Laboratory Equipment

Laboratory equipment, such as ovens and refrigerators which are required to maintain specific temperature ranges, will be monitored daily with thermometers that are calibrated annually against an NIST certified thermometer. For oven temperature requirements, please refer to the method specific SOPs. Freezer temperatures must be maintained between -10°C and -20°C. The refrigerator must be maintained at 4°C.

9. ANALYTICAL PROCEDURES

The Dayton Division of TestAmerica Inc. uses a wide range of analytical methodology for the analysis of wastewater, groundwater, drinking water, and hazardous waste. The tables in this Section list the methods routinely performed.

9.1 Methodology

The analytical methodology performed by TestAmerica conforms to acceptable methods as listed in the governing environmental regulations. Methods are referenced from Standard Methods for the Examination of Water and Wastewater; U.S. EPA Manual 600/4-79-020, "Methods of Chemical Analysis of Water and Wastes"; U.S. EPA Manual SW-846, Test Methods for Evaluating Solid Waste"; relevant ASTM, NIOSH and other publications.

The methods listed in Tables 9.1 through 9.5 are representative of analyses which are routinely performed. This laboratory has the capability to perform other methods. If a method of interest is not listed in this document, consult a Customer Service Representative or Project Manager to see if the laboratory is capable of performing the analysis.

9.2 Reporting Limits

TestAmerica has established reporting limits for all routine analyses. Ideally, reporting limits are based on the Limit of Quantitation (LOQ) that was determined when method detection limit studies were performed. Due to permit requirements or other client requirements it may be necessary to report at a value below the LOQ but still above the MDL. At no time will results be reported at less than the calculated MDL. The LOQ is defined as the level above which quantitative results may be obtained with a specified degree of confidence. The LOQ is calculated as ten times the standard deviation of the population of data obtained in the method detection limit study.

Method detection limit studies are performed annually on all analytes. These studies are performed in accordance with procedures in CFR Part 136 Appendix B.

The tables 1 show the reporting limits used by TestAmerica Dayton. Reporting limits listed are based on minimal matrix interference for aqueous samples. Actual reporting limits may vary due to sample matrix and sample dilution requirements.

Table 9.1. Analytical Methods and Reporting Limits - Potables

Parameter	Method Reference	Method Description	Reporting Limit	
Wet Chemistry				
Alkalinity	SM 2320	Titration	10	mg/L
Chloride	SM 4500Cl-B	Argentometric	5	mg/L
Total Residual Chlorine	SM 4500Cl-G	DPD Colorimetric	0.1	mg/L
Coliform, Total	MMO-MUG	Colilert/Colisure	Presence/Absence	
Coliform, E. Coli	MMO-MUG	Colilert/Colisure	Presence/Absence	
Cyanide, Total	EPA-335.4	Spectrophotometric	0.005	mg/L
Fluoride	SM 4500F-C	Ion-Selective Electrode	0.05	mg/L
Gross Alpha	EPA 900.0	Alpha Emission	3	pCi/L
Gross Beta	EPA 900.0	Beta Emission	4	pCi/L
Hardness, Total (CaCO3)	EPA-130.2	Titration, EDTA	5	mg/L
Nitrogen, Nitrate	SM 4500NO3-F	Automated Cd Reduction	0.02	mg/L
Nitrogen, Nitrite	SM 4500NO3-F	Automated Cd Reduction	0.02	mg/L
Nitrogen, Nitrate + Nitrite	SM 4500NO3-F	Automated Cd Reduction	0.02	mg/L
pH	EPA-150.1	Potentiometric	0.1	S.U.
Phosphorus, Total	SM 4500P-E	Spectrophotometric	0.10	mg/L
Stability	SM 2330	Calcium Carbonate Saturation	NA	
Total Dissolved Solids	SM 2540 C	Gravimetric, 180°C	50	mg/L
Turbidity	EPA-180.1	Nephelometric	1.0	NTU
Metals				
Aluminum (Al)	EPA-200.7	ICP	100	ug/L
	EPA-200.8	ICP-MS	100	ug/L
Antimony (Sb)	EPA-200.7	ICP	100	ug/L
	EPA-200.8	ICP-MS	4.0	ug/L
	EPA-200.9	GFAA	4.0	ug/L
Arsenic (As)	EPA-200.7	ICP	100	ug/L
	EPA-200.8	ICP-MS	5.0	ug/L
	EPA-200.9	GFAA	5.0	ug/L

Table 9.1. Continued...

Parameter	Method Reference	Method Description	Reporting Limit
Barium (Ba)	EPA-200.7	ICP	300 ug/L
	EPA-200.8	ICP-MS	300 ug/L
Beryllium (Be)	EPA-200.7	ICP	5.0 ug/L
	EPA-200.8	ICP-MS	1.0 ug/L
	EPA-200.9	GFAA	1.0 ug/L
Boron (B)	EPA-200.7	ICP	50 ug/L
Cadmium (Cd)	EPA-200.7	ICP	30.0 ug/L
	EPA-200.8	ICP-MS	1.0 ug/L
	EPA-200.9	GFAA	1.0 ug/L
Calcium (Ca)	EPA-200.7	ICP	1000 ug/L
Chromium (Cr)	EPA-200.7	ICP	40.0 ug/L
	EPA-200.8	ICP-MS	10.0 ug/L
	EPA-200.9	GFAA	10.0 ug/L
Cobalt (Co)	EPA-200.7	ICP	20.0 ug/L
	EPA-200.8	ICP-MS	5.0 ug/L
Copper (Cu)	EPA-200.7	ICP	50.0 ug/L
	EPA-200.8	ICP-MS	50.0 ug/L
Iron (Fe)	EPA-200.7	ICP	100 ug/L
Hardness	EPA-200.7	Calculation (ICP)	10000 ug/L
Lead (Pb)	EPA-200.7	ICP	80.0 ug/L
	EPA-200.8	ICP-MS	5.0 ug/L
	EPA-200.9	GFAA	5.0 ug/L
Magnesium (Mg)	EPA-200.7	ICP	1000 ug/L
Manganese (Mn)	EPA-200.7	ICP	10.0 ug/L
	EPA-200.8	ICP-MS	10.0 ug/L
Mercury (Hg)	EPA-245.1	Automated Cold Vapor	0.5 ug/L
	EPA-200.8	ICP-MS	0.5 ug/L
Molybdenum (Mo)	EPA-200.7	ICP	20.0 ug/L
	EPA-200.8	ICP-MS	5.0 ug/L
Nickel (Ni)	EPA-200.7	ICP	10.0 ug/L
	EPA-200.8	ICP-MS	5.0 ug/L
Potassium (K)	EPA-200.7	ICP	1000 ug/L

Table 9.1. Continued...

Parameter	Method Reference	Method Description	Reporting Limit
Selenium (Se)	EPA-200.7	ICP	100 ug/L
	EPA-200.8	ICP-MS	5.0 ug/L
	EPA-200.9	GFAA	5.0 ug/L
Silver (Ag)	EPA-200.7	ICP	40.0 ug/L
	EPA-200.8	ICP-MS	40.0 ug/L
	EPA-200.9	GFAA	40.0 ug/L
Sodium (Na)	EPA-200.7	ICP	1000 ug/L
Strontium (Sr)	EPA-200.7	ICP	1000 ug/L
Thallium (Tl)	EPA-200.8	ICP-MS	1.5 ug/L
	EPA-200.9	GFAA	1.5 ug/L
Tin (Sn)	EPA-200.7	ICP	2000 ug/L
Vanadium (V)	EPA-200.7	ICP	50.0 ug/L
	EPA-200.8	ICP-MS	5.0 ug/L
Zinc (Zn)	EPA-200.7	ICP	50.0 ug/L
	EPA-200.8	ICP-MS	50.0 ug/L
ORGANICS			
Benzene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Bromobenzene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Bromochloromethane	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Bromodichloromethane	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Bromoform	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Bromomethane	EPA 524.2	GC/MS Volatiles	0.5 ug/L
n-Butylbenzene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
tert-Butylbenzene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
sec-Butylbenzene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Carbon Tetrachloride	EPA 524.2	GC/MS Volatiles	0.5 ug/L

Table 9.1. Continued...

Parameter	Method Reference	Method Description	Reporting Limit
Chlorobenzene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Chloroethane	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Chloroform	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Chloromethane	EPA 524.2	GC/MS Volatiles	0.5 ug/L
o-Chlorotoluene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
p-Chlorotoluene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Dibromochloromethane	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Dibromomethane	EPA 524.2	GC/MS Volatiles	0.5 ug/L
1,2-Dichlorobenzene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
1,3-Dichlorobenzene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
1,4-Dichlorobenzene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
1,1-Dichloroethane	EPA 524.2	GC/MS Volatiles	0.5 ug/L
1,2-Dichloroethane	EPA 524.2	GC/MS Volatiles	0.5 ug/L
1,1-Dichloroethene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
cis-1,2,Dichloroethene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
trans-1,2-Dichloroethene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
1,1-Dichloropropene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
1,2-Dichloropropane	EPA 524.2	GC/MS Volatiles	0.5 ug/L
cis-1,3-Dichloropropene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
trans-1,3-Dichloropropene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
1,3-Dichloropropane	EPA 524.2	GC/MS Volatiles	0.5 ug/L
2,2-Dichloropropane	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Ethyl benzene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Fluorotrichloromethane	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Hexachlorobutadiene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Isopropylbenzene	EPA 524.2	GC/MS Volatiles	0.5 ug/L

Table 9.1. Continued...

Parameter	Method Reference	Method Description	Reporting Limit
p-Isopropyltoluene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Methylene Chloride	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Naphthalene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
n-Propylbenzene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Styrene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
1,1,1,2-Tetrachloroethane	EPA 524.2	GC/MS Volatiles	0.5 ug/L
1,1,2,2-Tetrachloroethane	EPA 524.2	GC/MS Volatiles	0.5 ug/L
1,2,3-Trichloropropane	EPA 524.2	GC/MS Volatiles	0.5 ug/L
1,2,4-Trichlorobenzene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
1,2,3-Trichlorobenzene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
1,2,4-Trimethylbenzene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
1,3,5-Trimethylbenzene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Tetrachloroethene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Toluene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
1,1,1-Trichloroethane	EPA 524.2	GC/MS Volatiles	0.5 ug/L
1,1,2-Trichloroethane	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Trichloroethene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Vinyl Chloride	EPA 524.2	GC/MS Volatiles	0.5 ug/L
o-Xylene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
m & p Xylene	EPA 524.2	GC/MS Volatiles	0.5 ug/L
Xylenes, total	EPA 524.2	GC/MS Volatiles	0.5 ug/L

Table 9.2. Analytical Methods and Reporting Limits - RCRA

Parameter	Method Reference	Method Description	Reporting Limit Aqueous	Reporting Limit Non-Aqueous
Wet Chemistry				
Cyanide, Amenable	SW-9012	Spectrophotometric	0.005 mg/L	0.125 mg/Kg
Cyanide, Total	SW-9012	Spectrophotometric	0.005 mg/L	0.125 mg/Kg
Hexavalent Chromium	SW-7196A	Colorimetric	0.010 mg/L	5.0 mg/Kg
Ignitability	SW-1010	Pensky Martins	NA	NA
Oil & Grease	SW-9070	Gravimetric	5.0 mg/L	
Paint Filter Test	SW-9095A	NA	NA	NA
pH	SW-9040B, SW-9041A, SW-9045C	Potentiometric, pH Paper	NA	NA
TCLP Extraction	SW-1311	18 hr Extraction	NA	NA
Metals				
Aluminum (Al)	SW-6010A	ICP	0.10 mg/L	5.0 mg/Kg
	SW-6020	ICP-MS	0.050 mg/L	50.0 mg/Kg
Antimony (Sb)	SW-6010A	ICP	0.10 mg/L	5.0 mg/Kg
	SW-6020	ICP-MS	0.001 mg/L	1.0 mg/Kg
	SW-7041	GFAA	0.020 mg/L	1.0 mg/Kg
Arsenic (As)	SW-6010A	ICP	0.10 mg/L	5.0 mg/Kg
	SW-6020	ICP-MS	0.005 mg/L	5.0 mg/Kg
	SW-7060A	GFAA	0.005 mg/L	0.25 mg/Kg
Barium (Ba)	SW-6010A	ICP	0.020 mg/L	1.0 mg/Kg
	SW-6020	ICP-MS	0.005 mg/L	5.0 mg/Kg
Beryllium (Be)	SW-6010A	ICP	0.005 mg/L	0.25 mg/Kg
	SW-6020	ICP-MS	0.001 mg/L	1.0 mg/Kg
	SW-7091	GFAA	0.001 mg/L	0.05 mg/Kg
Boron (B)	SW-6010A	ICP	0.050 mg/L	2.5 mg/Kg
Cadmium (Cd)	SW-6010A	ICP	0.030 mg/L	1.5 mg/Kg
	SW-6020	ICP-MS	0.001 mg/L	1.0 mg/Kg
	SW-7131A	GFAA	0.001 mg/L	0.05 mg/Kg
Calcium (Ca)	SW-6010A	ICP	1.0 mg/L	50.0 mg/Kg
Chromium (Cr)	SW-6010A	ICP	0.040 mg/L	2.0 mg/Kg
	SW-6020	ICP-MS	0.002 mg/L	2.0 mg/Kg
	SW-7191	GFAA	0.002 mg/L	0.1 mg/Kg

Table 9.2. Continued

Parameter	Method Reference	Method Description	Reporting Limit	
			Aqueous	Non-Aqueous
Cobalt (Co)	SW-6010A	ICP	0.020 mg/L	1.0 mg/Kg
	SW-6020	ICP-MS	0.005 mg/L	5.0 mg/Kg
	SW-7201	GFAA	0.005 mg/L	0.25 mg/Kg
Copper (Cu)	SW-6010A	ICP	0.020 mg/L	1.0 mg/Kg
	SW-6020	ICP-MS	0.005 mg/L	5.0 mg/Kg
Iron (Fe)	SW-6010A	ICP	0.10 mg/L	5.0 mg/Kg
Lead (Pb)	SW-6010A	ICP	0.080 mg/L	4.0 mg/Kg
	SW-6020	ICP-MS	0.001 mg/L	1.0 mg/Kg
	SW-7421	GFAA	0.005 mg/L	0.25 mg/Kg
Magnesium (Mg)	SW-6010A	ICP	1.0 mg/L	50.0 mg/Kg
Manganese (Mn)	SW-6010A	ICP	0.010 mg/L	0.50 mg/Kg
	SW-6020	ICP-MS	0.010 mg/L	10.0 mg/Kg
Mercury (Hg)	SW-7470A/SW-7471A	Automated Cold Vapor	0.0002 mg/L	0.01 mg/Kg
Molybdenum (Mo)	SW-6010A	ICP	0.020 mg/L	1.0 mg/Kg
	SW-6020	ICP-MS	0.001 mg/L	1.0 mg/Kg
Nickel (Ni)	SW-6010A	ICP	0.010 mg/L	0.5 mg/Kg
	SW-6020	ICP-MS	0.005 mg/L	5.0 mg/Kg
Potassium (K)	SW-6010A	ICP	1.0 mg/L	50.0 mg/Kg
Selenium (Se)	SW-6010A	ICP	0.10 mg/L	5.0 mg/Kg
	SW-6020	ICP-MS	0.005 mg/L	5.0 mg/Kg
	SW-7740	GFAA	0.005 mg/L	0.25 mg/Kg
Silver (Ag)	SW-6010A	ICP	0.040 mg/L	2.0 mg/Kg
	SW-6020	ICP-MS	0.0005 mg/L	0.5 mg/Kg
	SW-7761	GFAA	0.001 mg/L	0.05 mg/Kg
Sodium (Na)	SW-6010A	ICP	1.0 mg/L	50.0 mg/Kg
Strontium (Sr)	SW-6010A	ICP	0.10 mg/L	5.0 mg/Kg
Thallium (Tl)	SW-6010A	ICP	0.50 mg/L	25 mg/Kg
	SW-6020	ICP-MS	0.001 mg/L	1.0 mg/Kg
	SW-7841	GFAA	0.010 mg/L	0.5 mg/Kg
Tin (Sn)	SW-6010A	ICP	2.0 mg/L	100 mg/Kg
Titanium (Ti)	SW-6010A	ICP	0.020 mg/L	1.0 mg/Kg

Table 9.2. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous	Reporting Limit Non-Aqueous
Vanadium (V)	SW-6010A	ICP	0.050 mg/L	2.5 mg/Kg
	SW-6020	ICP-MS	0.005 mg/L	5.0 mg/Kg
Zinc (Zn)	SW-6010A	ICP	0.050 mg/L	2.5 mg/Kg
	SW-6020	ICP-MS	0.050 mg/L	50 mg/Kg
Organics - Volatile Compounds				
Acetone	SW-8260A	GC/MS	20 ug/L	100 ug/Kg
Acrolein	SW-8260A	GC/MS	50 ug/L	50 ug/Kg
Acrylonitrile	SW-8260A	GC/MS	50 ug/L	50 ug/Kg
Allyl chloride	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
Benzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Bromobenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Bromochloromethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Bromodichloromethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Bromoform	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Bromomethane	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
n-Butylbenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
tert-Butylbenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
sec-Butylbenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
2-Butanone (MEK)	SW-8260A	GC/MS	20 ug/L	100 ug/Kg
Carbon Disulfide	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Carbon Tetrachloride	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Chlorobenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Chloroethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
2-Chloroethylvinyl ether	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
Chloroform	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Chloromethane	SW-8260A	GC/MS	5.0 ug/L	10.0 ug/Kg

Table 9.2. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous	Reporting Limit Non-Aqueous
Chloroprene	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
o-Chlorotoluene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
p-Chlorotoluene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Dibromochloromethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
1,2-Dibromo-3-Chloropropane	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
1,2-Dibromoethane	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
Dibromomethane	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
1,2-Dichlorobenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
1,3-Dichlorobenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
1,4-Dichlorobenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
trans-1,4-Dichloro-2-butene	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
Dichlorodifluoromethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
1,1-Dichloroethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
1,2-Dichloroethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
1,1-Dichloroethene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
cis-1,2,Dichloroethene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
trans-1,2-Dichloroethene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
1,1-Dichloropropene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
1,2-Dichloropropane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
cis-1,3-Dichloropropene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
trans-1,3-Dichloropropene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
1,3-Dichloropropane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
2,2-Dichloropropane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Ethyl benzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Ethyl methacrylate	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg

Table 9.2. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous	Reporting Limit Non-Aqueous
Fluorotrichloromethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Hexachlorobutadiene	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
2-Hexanone	SW-8260A	GC/MS	10 ug/L	50 ug/Kg
Iodomethane	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
Isopropylbenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
p-Isopropyltoluene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Methacrylonitrile	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Methylene Chloride	SW-8260A	GC/MS	10 ug/L	10 ug/Kg
4-Methyl-2-pentanone (MIBK)	SW-8260A	GC/MS	10 ug/L	50 ug/Kg
Methyl tert butyl ether (MTBE)	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Methyl methacrylate	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Naphthalene	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
Propionitrile	SW-8260A	GC/MS	50 ug/L	50 ug/Kg
n-Propylbenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Styrene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
1,1,1,2-Tetrachloroethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
1,1,2,2-Tetrachloroethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
1,2,3-Trichloropropane	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
1,2,4-Trichlorobenzene	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
1,2,3-Trichlorobenzene	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
1,2,4-Trimethylbenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
1,3,5-Trimethylbenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Tetrachloroethene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Toluene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
1,1,1-Trichloroethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg

Table 9.2. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous		Reporting Limit Non-Aqueous	
1,1,2-Trichloroethane	SW-8260A	GC/MS	1.0	ug/L	5.0	ug/Kg
Trichloroethene	SW-8260A	GC/MS	1.0	ug/L	5.0	ug/Kg
Vinyl Acetate	SW-8260A	GC/MS	5.0	ug/L	5.0	ug/Kg
Vinyl Chloride	SW-8260A	GC/MS	2.0	ug/L	2.0	ug/Kg
o-Xylene	SW-8260A	GC/MS	1.0	ug/L	5.0	ug/Kg
m & p Xylene	SW-8260A	GC/MS	1.0	ug/L	5.0	ug/Kg
Xylenes, total	SW-8260A	GC/MS	1.0	ug/L	5.0	ug/Kg
n-Hexane	SW-8260A	GC/MS	10	ug/L	10	ug/Kg
SEMI-VOLATILE COMPOUNDS						
Acenaphthene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Acenaphthylene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Acetophenone	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
2-Acetylaminoflourene (2-AAF)	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
4-Aminobipheyl	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Aniline	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Anthracene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Aramite	SW-8270B	GC/MS	15	ug/L	495	ug/Kg
Benzidine	SW-8270B	GC/MS	50	ug/L	1,650	ug/Kg
Benzo(a)anthracene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Benzo(b)fluoranthene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Benzo(k)fluoranthene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Benzo(a)pyrene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Benzo(g,h,i)perylene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Benzyl alcohol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Benzyl butyl phthalate	SW-8270B	GC/MS	10	ug/L	330	ug/Kg

Table 9.2. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous		Reporting Limit Non-Aqueous	
Bis(2-chloroethyl)ether	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Bis(2-chloroethoxy)methane	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Bis(2-ethylhexyl)phthalate	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Bis(2-chloroisopropyl)ether	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
4-Bromophenyl phenyl ether	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
4-Chloroaniline	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Chlorobenzilate	SW-8270B	GC/MS	50	ug/L	1,650	ug/Kg
2-Chloronaphthalene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
4-Chlorophenyl phenyl ether	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Chrysene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Diallate	SW-8270B	GC/MS	30	ug/L	990	ug/Kg
Dibenzo(a,h)anthracene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Dibenzofuran	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Di-n-butylphthalate	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
1,2-Dichlorobenzene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
1,3-Dichlorobenzene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
1,4-Dichlorobenzene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
3,3-Dichlorobenzidine	SW-8270B	GC/MS	50	ug/L	1,650	ug/Kg
Diethyl phthalate	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Dimethoate	SW-8270B	GC/MS	100	ug/L	3,300	ug/Kg
p-(Dimethylamino)-azobenzene	SW-8270B	GC/MS	50	ug/L	1,650	ug/Kg
7,12-Dimethylbenz(a)anthracene	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
3,3'-Dimethylbenzidine	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
a,a-Dimethyl-phenethylamino	SW-8270B	GC/MS	50	ug/L	1,650	ug/Kg
Dimethyl phthalate	SW-8270B	GC/MS	10	ug/L	330	ug/Kg

Table 9.2. Continued

Parameter	Method Reference	Method Description	Reporting Limit			
			Aqueous		Non-Aqueous	
2,4-Dinitrotoluene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2,6-Dinitrotoluene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Di-n-octylphthalate	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Diphenylhydrazine	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Diphenylamine	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Disulfoton	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Ethyl methanesulfonate	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Famphur	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Fluoranthene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Fluorene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Hexachlorobenzene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Hexachlorobutadiene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Hexachlorocyclopentadiene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Hexachloroethane	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Hexachlorophene	SW-8270B	GC/MS	500	ug/L	16,500	ug/Kg
Hexachloropropene	SW-8270B	GC/MS	30	ug/L	990	ug/Kg
Indeno(1,2,3-cd)pyrene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Isodrin	SW-8270B	GC/MS	30	ug/L	990	ug/Kg
Isophorone	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Isosafrole	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Kepone	SW-8270B	GC/MS	250	ug/L	8,250	ug/Kg
Methapryilene	SW-8270B	GC/MS	100	ug/L	3,300	ug/Kg
3-Methylcholanthrene	SW-8270B	GC/MS	30	ug/L	990	ug/Kg
Methyl methanesulfonate	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
2-Methylnapthalene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg

Table 9.2. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous		Reporting Limit Non-Aqueous	
Methyl parathion	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Naphthalene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
1,4 Napthoquinone	SW-8270B	GC/MS	100	ug/L	3,300	ug/Kg
1-Napthylamine	SW-8270B	GC/MS	30	ug/L	990	ug/Kg
2-Napthylamine	SW-8270B	GC/MS	30	ug/L	990	ug/Kg
Nitrobenzene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2-Nitroaniline	SW-8270B	GC/MS	15	ug/L	495	ug/Kg
3-Nitroaniline	SW-8270B	GC/MS	15	ug/L	495	ug/Kg
4-Nitroaniline	SW-8270B	GC/MS	15	ug/L	495	ug/Kg
4-Nitroquinoline-1-oxide	SW-8270B	GC/MS	30	ug/L	990	ug/Kg
N-Nitrosodi-n-butylamine	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
N-Nitrosodiethylamine	SW-8270B	GC/MS	30	ug/L	660	ug/Kg
N-Nitrosodimethylamine	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
N-Nitrosodiphenylamine	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
N-Nitrosodipropylamine	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
N-Nitrosomethylethylamine	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
N-Nitrosomorpholine	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
N-Nitrosopiperidine	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
N-Nitrosopyrrolidine	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
5-Nitro-o-toluidine	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Parathion	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Pentachlorobenzene	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Pentachloronitrobenzene	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Phenacetin	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Phenanthrene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg

Table 9.2. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous		Reporting Limit Non-Aqueous	
p-Phenylenediamine	SW-8270B	GC/MS	30	ug/L	990	ug/Kg
Phorate	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
2-Picoline	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Pronamide	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Pyrene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Pyridine	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Safrole	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Sulfotepp	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
1,2,4,5-Tetrachlorobenzene	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Thionazin	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
o-Toluidine	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
1,2,4-Trichlorobenzene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Triethyl phosphorothioate	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
1,3,5-Trinitrobenzene	SW-8270B	GC/MS	30	ug/L	990	ug/Kg
Benzoic Acid	SW-8270B	GC/MS	50	ug/L	1,650	ug/Kg
4-Chloro-3-methylphenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2-Chlorophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2,4-Dichlorophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2,6-Dichlorophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2,4-Dimethylphenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2,4-Dinitrophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2-Methyl-4,6-dinitrophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2-Nitrophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
4-Nitrophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Pentachlorophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg

Table 9.2. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous		Reporting Limit Non-Aqueous	
Phenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2,3,4,6-Tetrachlorophenol	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
2,4,5-Trichlorophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2,4,6-Trichlorophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2-Methylphenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
3 & 4-Methylphenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Pesticides/PCBs						
Aldrin	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
Chlordane	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
Dieldrin	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
4,4'-DDD	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
4,4'-DDE	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
4,4'-DDT	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
Endosulfan I	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
Endosulfan II	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
Endosulfan Sulfate	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
Endrin	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
Endrin Aldehyde	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
Endrin Ketone	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
Heptachlor	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
Heptachlor Epoxide	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
alpha-BHC	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
beta-BHC	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
gamma-BHC (Lindane)	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg

Table 9.2. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous		Reporting Limit Non-Aqueous
delta-BHC	SW-8080A	GC/ECD	0.2	ug/L	500 ug/Kg
Methoxychlor	SW-8080A	GC/ECD	0.2	ug/L	500 ug/Kg
Toxaphene	SW-8080A	GC/ECD	0.5	ug/L	500 ug/Kg
PCB-1016	SW-8080A	GC/ECD	0.2	ug/L	500 ug/Kg
PCB-1221	SW-8080A	GC/ECD	0.2	ug/L	500 ug/Kg
PCB-1232	SW-8080A	GC/ECD	0.2	ug/L	500 ug/Kg
PCB-1242	SW-8080A	GC/ECD	0.2	ug/L	500 ug/Kg
PCB-1248	SW-8080A	GC/ECD	0.2	ug/L	500 ug/Kg
PCB-1254	SW-8080A	GC/ECD	0.2	ug/L	500 ug/Kg
PCB-1260	SW-8080A	GC/ECD	0.2	ug/L	500 ug/Kg
GC - Glycols					
Ethylene Glycol	SW-8015 Modified	GC	1.0	mg/L	NA
Propylene Glycol	SW-8015 Modified	GC	1.0	mg/L	NA
Diethlylene Glycol	SW-8015 Modified	GC	1.0	mg/L	NA
GC - Alcohols					
Methanol	SW-8015 Modified	GC	5.0	mg/L	NA
Acetonitrile	SW-8015 Modified	GC	2.0	mg/L	NA
1,4-Dioxane	SW-8015 Modified	GC	5.0	mg/L	NA
Isobutanol	SW-8015 Modified	GC	3.0	mg/L	NA
n-Butanol	SW-8015 Modified	GC	5.0	mg/L	NA
GC - Volatiles					
Benzene	SW-8021B/SW-8020A	GC	1.0	ug/L	5.0 ug/Kg
Ethylbenzene	SW-8021B/SW-8020A	GC	1.0	ug/L	5.0 ug/Kg
Toluene	SW-8021B/SW-8020A	GC	1.0	ug/L	5.0 ug/Kg
m&p-Xylene	SW-8021B/SW-8020A	GC	1.0	ug/L	5.0 ug/Kg

Table 9.2. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous	Reporting Limit Non-Aqueous
o-Xylene	SW-8021B/SW-8020A	GC	1.0 ug/L	5.0 ug/Kg
Methyl-tert-butyl-ether	SW-8021B/SW-8020A	GC	1.0 ug/L	5.0 ug/Kg
HPLC - Polynuclear Aromatic Hydrocarbons				
Napthalene	SW-8310	HPLC	2.0 ug/L	200 ug/Kg
Acenaphthylene	SW-8310	HPLC	1.0 ug/L	100 ug/Kg
Acenaphthene	SW-8310	HPLC	1.0 ug/L	100 ug/Kg
Fluorene	SW-8310	HPLC	1.0 ug/L	100 ug/Kg
Phenanthrene	SW-8310	HPLC	1.0 ug/L	100 ug/Kg
Anthracene	SW-8310	HPLC	2.0 ug/L	100 ug/Kg
Fluoranthene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg
Pyrene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg
Benzo(a)anthracene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg
Chrysene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg
Benzo(b)fluoranthene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg
Benzo(k)fluoranthene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg
Benzo(a)pyrene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg
Dibenz(ah)anthracene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg
Benzo(ghi)perylene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg
Indeno(1,2,3-cd)pyrene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg
Total Petroleum Hydrocarbons	EPA 418.1	IR	2.0 mg/L	10 mg/Kg
Total Petroleum Hydrocarbons (Diesel Range Organics)	SW-8015B	GC	0.1 mg/L	4.0 mg/Kg
Total Petroleum Hydrocarbons (Gasoline Range Organics)	SW-8015B/SW-8015A Modified	GC	0.1 mg/L	0.5 mg/Kg

Table 9.3. Analytical Methods and Reporting Limits - NPDES

Parameter	Method Reference	Method Description	Reporting Limit Aqueous	Reporting Limit Non-Aqueous
Alkalinity	EPA-310.1/SM-2320B	Titration	10. mg/L	NA
Biochemical Oxygen Demand (BOD)	EPA-405.1/SM-5210B	DO Probe	4. mg/L	NA
Carbonaceous BOD (CBOD)	SM-5210B	DO Probe	4. mg/L	NA
Chemical Oxygen Demand (COD)	EPA-410.4/Hach 8000	Spectrophotometric	10. mg/l	NA
Chloride	SM-4500Cl-C	Mercuric Nitrate	5. mg/L	NA
Total Residual Chlorine	SM-4500Cl-G	DPD Colorimetric	0.1	NA
Coliform, Fecal	SM-9222 D	Membrane Filter		
Coliform, Total	MMO-MUG	Colilert/Colisure	Presence/Absence	
Coliform, E. Coli	MMO-MUG	Colilert/Colisure	Presence/Absence	
Color	SM-2120 B	Platinum Cobalt Units	1. C.U.	NA
Conductivity	EPA -120.1/SM-2510 B	umhos 25 degrees C	1. umhos	NA
Cyanide, Amenable	EPA-335.1/SM-4500CN-E,G	Mod. Spectrophotometric	0.005 mg/L	0.125 mg/Kg
Cyanide, Free	SM-4500CN-I	Mod. Spectrophotometric	0.005 mg/L	0.125 mg/Kg
Cyanide, Total	EPA-335.2/SM-4500CN-E	Mod. Spectrophotometric	0.005 mg/L	0.125 mg/Kg
Density	SM-2710 F			
Fluoride, Distilled	EPA-340.1,.2/SM-4500F,B,C	Ion-Selective Electrode	0.2 mg/L	NA
Hardness, Total (CaCO3)	EPA-130.2/SM-2340C	Titration, EDTA	5.0 mg/L	NA
Hexavalent Chromium	SM-3500-Cr D	Colorimetric	0.010 mg/L	5.0 mg/Kg
Nitrogen, Ammonia				
Free (Direct)	EPA-350.1/SM-4500NH3	Automated Phenate	0.05 mg/L	NA
Distilled	EPA-350.1/SM-4500NH3	Automated Phenate	0.3 mg/L	30. mg/Kg
Nitrogen, Kjeldahl	EPA-350.1/SM-4500NH3	Automated Phenate	0.5 mg/L	150 mg/Kg
Nitrogen, Nitrate	EPA-353.2/SM-4500-NO3 F	Automated Cd Reduction	0.02 mg/L	0.20 mg/Kg
Nitrogen, Nitrite	EPA-353.2/SM-4500-NO3 F	Automated Cd Reduction	0.02 mg/L	0.20 mg/Kg
Oil & Grease	EPA-413.1/SM-5520B,D	Gravimetric	5.0 mg/L	NA
Odor	SM 2150B		NA	NA

Table 9.3. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous		Reporting Limit Non-Aqueous	
Oxygen, Dissolved	EPA-360.1/SM-4500-O G.	Membrane Electrode	1.	mg/L	NA	
pH	EPA-150.1/SM-4500H-B	Potentiometric	NA		NA	
Phenols	EPA-420.1	Colorimetric	0.010	mg/L	0.25	mg/Kg
Phosphorus, Ortho	EPA-365.2/SM-4500P-E	Spectrophotometric	0.10	mg/L	NA	
Phosphorus, Total	EPA-365.2/SM-4500P-E	Spectrophotometric	0.10	mg/L	20.	mg/Kg
Sulfate	EPA-375.4	Turbidimetric	5.	mg/L	NA	
Sulfide, Total	EPA-376.1/SM-4500-S2 E	Titration	1.	mg/L	NA	
Sulfite	EPA-377.1	Titration	1.	mg/L	NA	
Surfactants (MBAS)	EPA-425.1/SM-5540-C	Colorimetric	0.030	mg/L	NA	
Total Dissolved Solids	EPA-160.1/SM-2540C	Gravimetric, 180°C	50.	mg/L	NA	
Total Suspended Solids	EPA-160.2/SM-2540D	Gravimetric, 103-105°C	3.	mg/L	NA	
Total Solids	EPA-160.3/SM-2540B	Gravimetric, 103-105°C	50.	mg/L	NA	
Total Volatile Solids	EPA-160.4	Gravimetric, 550°C	0.01	%	NA	
Total Organic Carbon (TOC)	SM-5310 B	Oxidation	1.0	mg/L	NA	
Total Petroleum HydroCarbons	EPA-418.1	Solvent extraction, IR	2.0	mg/L	10.	mg/Kg
Turbidity	EPA-180.1	Nephelometric	1.0	NTU	NA	
Metals						
Aluminum (Al)	EPA-200.7	ICP	0.10	mg/L	5.0	mg/Kg
	EPA-200.8	ICP-MS	0.050	mg/L	50.0	mg/Kg
Antimony (Sb)	EPA-200.7	ICP	0.10	mg/L	5.0	mg/Kg
	EPA-200.8	ICP-MS	0.001	mg/L	1.0	mg/Kg
	EPA-204.2	GFAA	0.020	mg/L	1.0	mg/Kg
Arsenic (As)	EPA-200.7	ICP	0.10	mg/L	5.0	mg/Kg
	EPA-200.8	ICP-MS	0.005	mg/L	5.0	mg/Kg
	EPA-206.2	GFAA	0.005	mg/L	0.25	mg/Kg
Barium (Ba)	EPA-200.7	ICP	0.020	mg/L	1.0	mg/Kg
	EPA-200.8	ICP-MS	0.005	mg/L	5.0	mg/Kg

Table 9.3. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous	Reporting Limit Non-Aqueous
Beryllium (Be)	EPA-200.7	ICP	0.005 mg/L	0.25 mg/Kg
	EPA-200.8	ICP-MS	0.001 mg/L	1.0 mg/Kg
	EPA-210.2	GFAA	0.001 mg/L	0.05 mg/Kg
Boron (B)	EPA-200.7	ICP	0.050 mg/L	2.5 mg/Kg
Cadmium (Cd)	EPA-200.7	ICP	0.030 mg/L	1.5 mg/Kg
	EPA-200.8	ICP-MS	0.001 mg/L	1.0 mg/Kg
	EPA-213.2	GFAA	0.001 mg/L	0.05 mg/Kg
Calcium (Ca)	EPA-200.7	ICP	1.0 mg/L	50.0 mg/Kg
Chromium (Cr)	EPA-200.7	ICP	0.040 mg/L	2.0 mg/Kg
	EPA-200.8	ICP-MS	0.002 mg/L	2.0 mg/Kg
	EPA-218.2	GFAA	0.002 mg/L	0.1 mg/Kg
Cobalt (Co)	EPA-200.7	ICP	0.020 mg/L	1.0 mg/Kg
	EPA-200.8	ICP-MS	0.005 mg/L	5.0 mg/Kg
	EPA-219.2	GFAA	0.005 mg/L	0.25 mg/Kg
Copper (Cu)	EPA-200.7	ICP	0.020 mg/L	1.0 mg/Kg
	EPA-200.8	ICP-MS	0.005 mg/L	5.0 mg/Kg
Iron (Fe)	EPA-200.7	ICP	0.10 mg/L	5.0 mg/Kg
Lead (Pb)	EPA-200.7	ICP	0.080 mg/L	4.0 mg/Kg
	EPA-200.8	ICP-MS	0.001 mg/L	1.0 mg/Kg
	EPA-239.2	GFAA	0.005 mg/L	0.25 mg/Kg
Magnesium (Mg)	EPA-200.7	ICP	1.0 mg/L	50.0 mg/Kg
Manganese (Mn)	EPA-200.7	ICP	0.010 mg/L	0.50 mg/Kg
	EPA-200.8	ICP-MS	0.010 mg/L	10.0 mg/Kg
Mercury (Hg)	EPA 245.1/245.5	Automated Cold Vapor	0.0002 mg/L	0.01 mg/Kg
Molybdenum (Mo)	EPA-200.7	ICP	0.020 mg/L	1.0 mg/Kg
	EPA-200.8	ICP-MS	0.001 mg/L	1.0 mg/Kg
Nickel (Ni)	EPA-200.7	ICP	0.010 mg/L	0.50 mg/Kg
	EPA-200.8	ICP-MS	0.005 mg/L	5.0 mg/Kg
Potassium (K)	EPA-200.7	ICP	1.0 mg/L	50.0 mg/Kg
Selenium (Se)	EPA-200.7	ICP	0.10 mg/L	5.0 mg/Kg
	EPA-200.8	ICP-MS	0.005 mg/L	5.0 mg/Kg
	EPA-270.2	GFAA	0.005 mg/L	0.25 mg/Kg

Table 9.3. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous		Reporting Limit Non-Aqueous	
Silver (Ag)	EPA-200.7	ICP	0.040	mg/L	2.0	mg/Kg
	EPA-200.8	ICP-MS	0.0005	mg/L	0.5	mg/Kg
	EPA-272.2	GFAA	0.001	mg/L	0.05	mg/Kg
Sodium (Na)	EPA-200.7	ICP	1.0	mg/L	50.0	mg/Kg
Strontium (Sr)	EPA-200.7	ICP	0.10	mg/L	5.0	mg/Kg
Thallium (Tl)	EPA-200.7	ICP	0.50	mg/L	25	mg/Kg
	EPA-200.8	ICP-MS	0.001	mg/L	1.0	mg/Kg
	EPA-279.2	GFAA	0.010	mg/L	0.5	mg/Kg
Tin (Sn)	EPA-200.7	ICP	2.0	mg/L	100	mg/Kg
Titanium (Ti)	EPA-200.7	ICP	0.020	mg/L	1.0	mg/Kg
Vanadium (V)	EPA-200.7	ICP	0.050	mg/L	2.5	mg/Kg
	EPA-200.8	ICP-MS	0.005	mg/L	5.0	mg/Kg
Zinc (Zn)	EPA-200.7	ICP	0.050	mg/L	2.5	mg/Kg
	EPA-200.8	ICP-MS	0.050	mg/L	50	mg/Kg
Organics - Volatiles						
Acetone	EPA-624	GC/MS	20	ug/L	5.0	mg/Kg
Acrolein (Screen)	EPA-624	GC/MS	50	ug/L	12.5	mg/Kg
Acrylonitrile (Screen)	EPA-624	GC/MS	50	ug/L	5.0	mg/kg
Benzene	EPA-624	GC/MS	1.0	ug/L	0.25	mg/Kg
Bromodichloromethane	EPA-624	GC/MS	1.0	ug/L	0.25	mg/Kg
Bromoform	EPA-624	GC/MS	1.0	ug/L	0.25	mg/Kg
Bromomethane	EPA-624	GC/MS	1.0	ug/L	0.25	mg/Kg
2-Butanone (MEK)	EPA-624	GC/MS	10.0	ug/L	2.5	mg/Kg
Carbon Disulfide	EPA-624	GC/MS	1.0	ug/L	0.25	mg/Kg
Carbon Tetrachloride	EPA-624	GC/MS	1.0	ug/L	0.25	mg/Kg
Chlorobenzene	EPA-624	GC/MS	1.0	ug/L	0.25	mg/Kg
Chloroethane	EPA-624	GC/MS	5.0	ug/L	0.25	mg/Kg
2-Chloroethylvinyl ether	EPA-624	GC/MS	1.0	ug/L	0.25	mg/Kg

Table 9.3. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous	Reporting Limit Non-Aqueous
Chloroform	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
Chloromethane	EPA-624	GC/MS	10.0 ug/L	2.5 mg/Kg
Dibromochloromethane	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
1,2-Dichlorobenzene	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
1,3-Dichlorobenzene	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
1,4-Dichlorobenzene	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
1,1-Dichloroethane	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
1,2-Dichloroethane	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
1,1-Dichloroethene	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
cis-1,2,Dichloroethene	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
trans-1,2-Dichloroethene	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
1,2-Dichloropropane	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
cis-1,3-Dichloropropene	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
trans-1,3-Dichloropropene	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
Ethyl benzene	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
Methylene Chloride	EPA-624	GC/MS	10.0 ug/L	0.25 mg/Kg
4-Methyl-2-pentanone (MIBK)	EPA-624	GC/MS	10.0 ug/L	0.25 mg/Kg
Styrene	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
1,1,2,2-Tetrachloroethane	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
1,2,4-Trimethylbenzene	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
1,3,5-Trimethylbenzene	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
Tetrachloroethene	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
Toluene	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
1,1,1-Trichloroethane	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
1,1,2-Trichloroethane	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg

Table 9.3. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous	Reporting Limit Non-Aqueous
Trichloroethene	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
Vinyl Chloride	EPA-624	GC/MS	2.0 ug/L	0.25 mg/Kg
Xylenes, total	EPA-624	GC/MS	1.0 ug/L	0.25 mg/Kg
Organics - Semi-Volatiles				
Acenaphthene	EPA-625	GC/MS	5. ug/L	165 ug/Kg
Acenaphthylene	EPA-625	GC/MS	5. ug/L	165 ug/Kg
Anthracene	EPA-625	GC/MS	5. ug/L	165 ug/Kg
Benzidine	EPA-625	GC/MS	50. ug/L	1,650 ug/Kg
Benzo(a)anthracene	EPA-625	GC/MS	5. ug/L	165 ug/Kg
Benzo(b)fluoranthene	EPA-625	GC/MS	10. ug/L	330 ug/Kg
Benzo(k)fluoranthene	EPA-625	GC/MS	10. ug/L	330 ug/Kg
Benzo(a)pyrene	EPA-625	GC/MS	5. ug/L	165 ug/Kg
Benzo(g,h,i)perylene	EPA-625	GC/MS	5. ug/L	165 ug/Kg
Benzyl butyl phthalate	EPA-625	GC/MS	5. ug/L	165 ug/Kg
Bis(2-chloroethyl)ether	EPA-625	GC/MS	5. ug/L	165 ug/Kg
Bis(2-chloroethoxy)methane	EPA-625	GC/MS	5. ug/L	165 ug/Kg
Bis(2-ethylhexyl)phthalate	EPA-625	GC/MS	5. ug/L	165 ug/Kg
Bis(2-chloroisopropyl)ether	EPA-625	GC/MS	5. ug/L	165 ug/Kg
4-Bromophenyl phenyl ether	EPA-625	GC/MS	5. ug/L	165 ug/Kg
2-Chloronaphthalene	EPA-625	GC/MS	5. ug/L	165 ug/Kg
4-Chlorophenyl phenyl ether	EPA-625	GC/MS	5. ug/L	165 ug/Kg
Chrysene	EPA-625	GC/MS	5. ug/L	165 ug/Kg
Dibenzo(a,h)anthracene	EPA-625	GC/MS	5. ug/L	165 ug/Kg
Di-n-butylphthalate	EPA-625	GC/MS	5. ug/L	165 ug/Kg
1,2-Dichlorobenzene	EPA-625	GC/MS	5. ug/L	165 ug/Kg

Table 9.3. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous		Reporting Limit Non-Aqueous	
1,3-Dichlorobenzene	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
1,4-Dichlorobenzene	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
3,3-Dichlorobenzidine	EPA-625	GC/MS	50.	ug/L	1,650	ug/Kg
1,2-Diphenylhydrazine	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
Diethyl phthalate	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
Dimethyl phthalate	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
2,4-Dinitrotoluene	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
2,6-Dinitrotoluene	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
Di-n-octylphthalate	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
Fluoranthene	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
Fluorene	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
Hexachlorobenzene	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
Hexachlorobutadiene	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
Hexachlorocyclopentadiene	EPA-625	GC/MS	20.	ug/L	660	ug/Kg
Hexachloroethane	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
Indeno(1,2,3-cd)pyrene	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
Isophorone	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
Naphthalene	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
Nitrobenzene	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
N-Nitrosodimethylamine	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
N-Nitrosodiphenylamine	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
N-Nitroso-di-n-propylamine	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
Phenanthrene	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
Pyrene	EPA-625	GC/MS	5.	ug/L	165	ug/Kg
1,2,4-Trichlorobenzene	EPA-625	GC/MS	5.	ug/L	165	ug/Kg

Table 9.3. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous		Reporting Limit Non-Aqueous	
4-Chloro-3-methylphenol	EPA-625	GC/MS	10.	ug/L	330	ug/Kg
2-Chlorophenol	EPA-625	GC/MS	10.	ug/L	330	ug/Kg
2,4-Dichlorophenol	EPA-625	GC/MS	10.	ug/L	330	ug/Kg
2,4-Dimethylphenol	EPA-625	GC/MS	10.	ug/L	330	ug/Kg
2,4-Dinitrophenol	EPA-625	GC/MS	10.	ug/L	330	ug/Kg
2-Methyl-4,6-dinitrophenol	EPA-625	GC/MS	10.	ug/L	330	ug/Kg
2-Nitrophenol	EPA-625	GC/MS	10.	ug/L	330	ug/Kg
4-Nitrophenol	EPA-625	GC/MS	10.	ug/L	330	ug/Kg
Pentachlorophenol	EPA-625	GC/MS	10.	ug/L	330	ug/Kg
Phenol	EPA-625	GC/MS	10.	ug/L	330	ug/Kg
2,4,6-Trichlorophenol	EPA-625	GC/MS	10.	ug/L	330	ug/Kg
2-Methylphenol	EPA-625	GC/MS	10.	ug/L	330	ug/Kg
4-Methylphenol	EPA-625	GC/MS	10.	ug/L	330	ug/Kg
Organics - Pesticides/PCBs						
Aldrin	EPA 608	GC/ECD	0.2	ug/L	500	ug/Kg
Chlordane	EPA 608	GC/ECD	0.2	ug/L	500	ug/Kg
Dieldrin	EPA 608	GC/ECD	0.2	ug/L	500	ug/Kg
4,4'-DDD	EPA 608	GC/ECD	0.2	ug/L	500	ug/Kg
4,4'-DDE	EPA 608	GC/ECD	0.2	ug/L	500	ug/Kg
4,4'-DDT	EPA 608	GC/ECD	0.2	ug/L	500	ug/Kg
Endosulfan I	EPA 608	GC/ECD	0.2	ug/L	500	ug/Kg
Endosulfan II	EPA 608	GC/ECD	0.2	ug/L	500	ug/Kg
Endosulfan Sulfate	EPA 608	GC/ECD	0.2	ug/L	500	ug/Kg
Endrin	EPA 608	GC/ECD	0.2	ug/L	500	ug/Kg
Endrin Aldehyde	EPA 608	GC/ECD	0.2	ug/L	500	ug/Kg

Table 9.3. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous	Reporting Limit Non-Aqueous
Endrin Ketone	EPA 608	GC/ECD	0.2 ug/L	500 ug/Kg
Heptachlor	EPA 608	GC/ECD	0.2 ug/L	500 ug/Kg
Heptachlor Epoxide	EPA 608	GC/ECD	0.2 ug/L	500 ug/Kg
alpha-BHC	EPA 608	GC/ECD	0.2 ug/L	500 ug/Kg
beta-BHC	EPA 608	GC/ECD	0.2 ug/L	500 ug/Kg
gamma-BHC (Lindane)	EPA 608	GC/ECD	0.2 ug/L	500 ug/Kg
delta-BHC	EPA 608	GC/ECD	0.2 ug/L	500 ug/Kg
Methoxychlor	EPA 608	GC/ECD	0.2 ug/L	500 ug/Kg
Toxaphene	EPA 608	GC/ECD	0.5 ug/L	500 ug/Kg
PCB-1016	EPA 608	GC/ECD	0.2 ug/L	500 ug/Kg
PCB-1221	EPA 608	GC/ECD	0.2 ug/L	500 ug/Kg
PCB-1232	EPA 608	GC/ECD	0.2 ug/L	500 ug/Kg
PCB-1242	EPA 608	GC/ECD	0.2 ug/L	500 ug/Kg
PCB-1248	EPA 608	GC/ECD	0.2 ug/L	500 ug/Kg
PCB-1254	EPA 608	GC/ECD	0.2 ug/L	500 ug/Kg
PCB-1260	EPA 608	GC/ECD	0.2 ug/L	500 ug/Kg
Organics - GC Volatiles				
1,2-Dibromo-3-chloropropane	EPA-504.1	GC/ECD	0.02 ug/L	NA
Ethylene Dibromide	EPA-504.1	GC/ECD	0.02 ug/L	NA

Table 9.4. Analytical Methods and Reporting Limits - Ohio VAP

Parameter	Method Reference	Method Description	Reporting Limit	
			Aqueous	Non-Aqueous
Wet Chemistry				
Cyanide, Total	EPA 335.2 CLP M	Spectrophotometric	0.005 mg/L	0.125 mg/Kg
Hexavalent Chromium	SW-7196A	Colorimetric	0.010 mg/L	5.0 mg/Kg
Phosphorus, Ortho	EPA-365.2	Spectrophotometric	0.10 mg/L	20. mg/Kg
Phosphorus, Total	EPA-365.2	Spectrophotometric	0.10 mg/L	20. mg/Kg
Metals				
Aluminum (Al)	SW-6010A	ICP	0.10 mg/L	5.0 mg/Kg
	SW-6020	ICP-MS	0.050 mg/L	50.0 mg/Kg
Antimony (Sb)	SW-6010A	ICP	0.10 mg/L	5.0 mg/Kg
	SW-6020	ICP-MS	0.001 mg/L	1.0 mg/Kg
	SW-7041	GFAA	0.020 mg/L	1.0 mg/Kg
Arsenic (As)	SW-6010A	ICP	0.10 mg/L	5.0 mg/Kg
	SW-6020	ICP-MS	0.005 mg/L	5.0 mg/Kg
	SW-7060A	GFAA	0.005 mg/L	0.25 mg/Kg
Barium (Ba)	SW-6010A	ICP	0.020 mg/L	1.0 mg/Kg
	SW-6020	ICP-MS	0.005 mg/L	5.0 mg/Kg
Beryllium (Be)	SW-6010A	ICP	0.005 mg/L	0.25 mg/Kg
	SW-6020	ICP-MS	0.001 mg/L	1.0 mg/Kg
	SW-7091	GFAA	0.001 mg/L	0.05 mg/Kg
Cadmium (Cd)	SW-6010A	ICP	0.030 mg/L	1.5 mg/Kg
	SW-6020	ICP-MS	0.001 mg/L	1.0 mg/Kg
	SW-7131A	GFAA	0.001 mg/L	0.05 mg/Kg
Calcium (Ca)	SW-6010A	ICP	1.0 mg/L	50.0 mg/Kg
Chromium (Cr)	SW-6010A	ICP	0.040 mg/L	2.0 mg/Kg
	SW-6020	ICP-MS	0.002 mg/L	2.0 mg/Kg
	SW-7191	GFAA	0.002 mg/L	0.1 mg/Kg
Cobalt (Co)	SW-6010A	ICP	0.020 mg/L	1.0 mg/Kg
	SW-6020	ICP-MS	0.005 mg/L	5.0 mg/Kg
Copper (Cu)	SW-6010A	ICP	0.020 mg/L	1.0 mg/Kg
	SW-6020	ICP-MS	0.005 mg/L	5.0 mg/Kg
Iron (Fe)	SW-6010A	ICP	0.10 mg/L	5.0 mg/Kg

Table 9.4. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous	Reporting Limit Non-Aqueous
Lead (Pb)	SW-6010A	ICP	0.080 mg/L	4.0 mg/Kg
	SW-6020	ICP-MS	0.001 mg/L	1.0 mg/Kg
	SW-7421	GFAA	0.005 mg/L	0.25 mg/Kg
Manganese (Mn)	SW-6010A	ICP	0.010 mg/L	0.50 mg/Kg
	SW-6020	ICP-MS	0.010 mg/L	10.0 mg/Kg
Mercury (Hg)	SW-7470A/SW-7471A	Automated Cold Vapor	0.0002 mg/L	0.01 mg/Kg
Nickel (Ni)	SW-6010A	ICP	0.010 mg/L	0.5 mg/Kg
	SW-6020	ICP-MS	0.005 mg/L	5.0 mg/Kg
Potassium (K)	SW-6010A	ICP	1.0 mg/L	50.0 mg/Kg
Selenium (Se)	SW-6010A	ICP	0.10 mg/L	5.0 mg/Kg
	SW-7740	GFAA	0.005 mg/L	0.25 mg/Kg
Silver (Ag)	SW-6010A	ICP	0.040 mg/L	2.0 mg/Kg
	SW-6020	ICP-MS	0.0005 mg/L	0.5 mg/Kg
	SW-7761	GFAA	0.001 mg/L	0.05 mg/Kg
Sodium (Na)	SW-6010A	ICP	1.0 mg/L	50.0 mg/Kg
Thallium (Tl)	SW-6010A	ICP	0.50 mg/L	25 mg/Kg
	SW-6020	ICP-MS	0.001 mg/L	1.0 mg/Kg
	SW-7841	GFAA	0.010 mg/L	0.5 mg/Kg
Vanadium (V)	SW-6010A	ICP	0.050 mg/L	2.5 mg/Kg
	EPA-200.8	ICP-MS	0.005 mg/L	5.0 mg/Kg
Zinc (Zn)	SW-6010A	ICP	0.050 mg/L	2.5 mg/Kg
	SW-6020	ICP-MS	0.050 mg/L	50 mg/Kg
Organics - Volatile Compounds				
Acetone	SW-8260A	GC/MS	20 ug/L	100 ug/Kg
Acrolein	SW-8260A	GC/MS	50 ug/L	50 ug/Kg
Acrylonitrile	SW-8260A	GC/MS	50 ug/L	50 ug/Kg
Allyl chloride	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
Benzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Bromobenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Bromochloromethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA

Table 9.4. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous	Reporting Limit Non-Aqueous
Bromodichloromethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Bromoform	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Bromomethane	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
n-Butylbenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
tert-Butylbenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
sec-Butylbenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
2-Butanone (MEK)	SW-8260A	GC/MS	20 ug/L	100 ug/Kg
Carbon Disulfide	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
Carbon Tetrachloride	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Chlorobenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Chloroethane	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
2-Chloroethylvinyl ether	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
Chloroform	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Chloromethane	SW-8260A	GC/MS	5.0 ug/L	10.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Chloroprene	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
o-Chlorotoluene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
p-Chlorotoluene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Dibromochloromethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA

Table 9.4. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous	Reporting Limit Non-Aqueous
1,2-Dibromo-3-Chloropropane	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
1,2-Dibromoethane	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
Dibromomethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
1,2-Dichlorobenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
1,3-Dichlorobenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
1,4-Dichlorobenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
trans-1,4-Dichloro-2-butene	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
Dichlorodifluoromethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
1,1-Dichloroethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
1,2-Dichloroethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
1,1-Dichloroethene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
cis-1,2,Dichloroethene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
trans-1,2-Dichloroethene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
1,1-Dichloropropene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
1,2-Dichloropropane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
cis-1,3-Dichloropropene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
trans-1,3-Dichloropropene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
1,3-Dichloropropane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA

Table 9.4. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous	Reporting Limit Non-Aqueous
2,2-Dichloropropane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Ethyl benzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Fluorotrichloromethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Hexachlorobutadiene	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
2-Hexanone	SW-8260A	GC/MS	10 ug/L	50 ug/Kg
Iodomethane	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
Isopropylbenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
p-Isopropyltoluene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Methylene Chloride	SW-8260A	GC/MS	10 ug/L	10 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
4-Methyl-2-pentanone (MIBK)	SW-8260A	GC/MS	10 ug/L	50 ug/Kg
Naphthalene	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Propionitrile	SW-8260A	GC/MS	50 ug/L	50 ug/Kg
n-Propylbenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Styrene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
1,1,1,2-Tetrachloroethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
1,1,2,2-Tetrachloroethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
1,2,3-Trichloropropane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
1,2,4-Trichlorobenzene	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA

Table 9.4. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous	Reporting Limit Non-Aqueous
1,2,3-Trichlorobenzene	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
1,2,4-Trimethylbenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
1,3,5-Trimethylbenzene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Tetrachloroethene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Toluene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
1,1,1-Trichloroethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
1,1,2-Trichloroethane	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Trichloroethene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Vinyl Acetate	SW-8260A	GC/MS	5.0 ug/L	5.0 ug/Kg
Vinyl Chloride	SW-8260A	GC/MS	2.0 ug/L	2.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
o-Xylene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
m & p Xylene	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
Xylenes, total	SW-8260A	GC/MS	1.0 ug/L	5.0 ug/Kg
	EPA 524.2	GC/MS	0.5 ug/L	NA
n-Hexane	SW-8260A	GC/MS	10 ug/L	10 ug/Kg
SEMI-VOLATILE COMPOUNDS				
Acenaphthene	SW-8270B	GC/MS	10 ug/L	330 ug/Kg
Acenaphthylene	SW-8270B	GC/MS	10 ug/L	330 ug/Kg
Acetophenone	SW-8270B	GC/MS	20 ug/L	660 ug/Kg
2-Acetylaminoflourene (2-AAF)	SW-8270B	GC/MS	20 ug/L	660 ug/Kg

Table 9.4. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous		Reporting Limit Non-Aqueous	
4-Aminobipheyl	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Aniline	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Anthracene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Aramite	SW-8270B	GC/MS	15	ug/L	495	ug/Kg
Benzidine	SW-8270B	GC/MS	50	ug/L	1,650	ug/Kg
Benzo(a)anthracene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Benzo(b)fluoranthene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Benzo(k)fluoranthene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Benzo(a)pyrene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Benzo(g,h,i)perylene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Benzyl alcohol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Benzyl butyl phthalate	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Bis(2-chloroethyl)ether	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Bis(2-chloroethoxy)methane	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Bis(2-ethylhexyl)phthalate	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Bis(2-chloroisopropyl)ether	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
4-Bromophenyl phenyl ether	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
4-Chloroaniline	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Chlorobenzilate	SW-8270B	GC/MS	50	ug/L	1,650	ug/Kg
2-Chloronaphthalene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
4-Chlorophenyl phenyl ether	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Chrysene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Diallate	SW-8270B	GC/MS	30	ug/L	990	ug/Kg
Dibenzo(a,h)anthracene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Dibenzofuran	SW-8270B	GC/MS	10	ug/L	330	ug/Kg

Table 9.4. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous		Reporting Limit Non-Aqueous	
Di-n-butylphthalate	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
1,2-Dichlorobenzene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
1,3-Dichlorobenzene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
1,4-Dichlorobenzene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
3,3-Dichlorobenzidine	SW-8270B	GC/MS	50	ug/L	1,650	ug/Kg
Diethyl phthalate	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Dimethoate	SW-8270B	GC/MS	100	ug/L	3,300	ug/Kg
p-(Dimethylamino)-azobenzene	SW-8270B	GC/MS	50	ug/L	1,650	ug/Kg
7,12-Dimethylbenz(a)anthracene	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
3,3'-Dimethylbenzidine	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
a,a-Dimethyl-phenethylamino	SW-8270B	GC/MS	50	ug/L	1,650	ug/Kg
Dimethyl phthalate	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2,4-Dinitrotoluene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2,6-Dinitrotoluene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Di-n-octylphthalate	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Diphenylhydrazine	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Diphenylamine	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Disulfoton	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Ethyl methanesulfonate	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Famphur	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Fluoranthene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Fluorene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Hexachlorobenzene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Hexachlorobutadiene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Hexachlorocyclopentadiene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg

Table 9.4. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous		Reporting Limit Non-Aqueous	
Hexachloroethane	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Hexachlorophene	SW-8270B	GC/MS	500	ug/L	16,500	ug/Kg
Hexachloropropene	SW-8270B	GC/MS	30	ug/L	990	ug/Kg
Indeno(1,2,3-cd)pyrene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Isodrin	SW-8270B	GC/MS	30	ug/L	990	ug/Kg
Isophorone	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Isosafrole	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Kepone	SW-8270B	GC/MS	250	ug/L	8,250	ug/Kg
Methapryilene	SW-8270B	GC/MS	100	ug/L	3,300	ug/Kg
3-Methylcholanthrene	SW-8270B	GC/MS	30	ug/L	990	ug/Kg
Methyl methanesulfonate	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
2-Methylnapthalene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Methyl parathion	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Naphthalene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
1,4 Napthoquinone	SW-8270B	GC/MS	100	ug/L	3,300	ug/Kg
1-Napthylamine	SW-8270B	GC/MS	30	ug/L	990	ug/Kg
2-Napthylamine	SW-8270B	GC/MS	30	ug/L	990	ug/Kg
Nitrobenzene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2-Nitroaniline	SW-8270B	GC/MS	15	ug/L	495	ug/Kg
3-Nitroaniline	SW-8270B	GC/MS	15	ug/L	495	ug/Kg
4-Nitroaniline	SW-8270B	GC/MS	15	ug/L	495	ug/Kg
4-Nitroquinoline-1-oxide	SW-8270B	GC/MS	30	ug/L	990	ug/Kg
N-Nitrosodi-n-butylamine	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
N-Nitrosodiethylamine	SW-8270B	GC/MS	30	ug/L	660	ug/Kg
N-Nitrosodimethylamine	SW-8270B	GC/MS	10	ug/L	330	ug/Kg

Table 9.4. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous		Reporting Limit Non-Aqueous	
N-Nitrosodiphenylamine	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
N-Nitrosodipropylamine	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
N-Nitrosomethylethylamine	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
N-Nitrosomorpholine	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
N-Nitrosopiperidine	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
N-Nitrosopyrrolidine	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
5-Nitro-o-toluidine	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Parathion	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Pentachlorobenzene	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Pentachloronitrobenzene	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Phenacetin	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Phenanthrene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
p-Phenylenediamine	SW-8270B	GC/MS	30	ug/L	990	ug/Kg
Phorate	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
2-Picoline	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Pronamide	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Pyrene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Pyridine	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Safrole	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Sulfotepp	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
1,2,4,5-Tetrachlorobenzene	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
Thionazin	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
o-Toluidine	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
1,2,4-Trichlorobenzene	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Triethyl phosphorothioate	SW-8270B	GC/MS	20	ug/L	660	ug/Kg

Table 9.4. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous		Reporting Limit Non-Aqueous	
1,3,5-Trinitrobenzene	SW-8270B	GC/MS	30	ug/L	990	ug/Kg
Benzoic Acid	SW-8270B	GC/MS	50	ug/L	1,650	ug/Kg
4-Chloro-3-methylphenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2-Chlorophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2,4-Dichlorophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2,6-Dichlorophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2,4-Dimethylphenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2,4-Dinitrophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2-Methyl-4,6-dinitrophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2-Nitrophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
4-Nitrophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Pentachlorophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Phenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2,3,4,6-Tetrachlorophenol	SW-8270B	GC/MS	20	ug/L	660	ug/Kg
2,4,5-Trichlorophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2,4,6-Trichlorophenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
2-Methylphenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
3 & 4-Methylphenol	SW-8270B	GC/MS	10	ug/L	330	ug/Kg
Pesticides/PCBs						
Aldrin	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
Chlordane	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
Dieldrin	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
4,4'-DDD	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg
4,4'-DDE	SW-8080A	GC/ECD	0.2	ug/L	500	ug/Kg

Table 9.4. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous	Reporting Limit Non-Aqueous
4,4'-DDT	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
Endosulfan I	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
Endosulfan II	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
Endosulfan Sulfate	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
Endrin	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
Endrin Aldehyde	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
Endrin Ketone	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
Heptachlor	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
Heptachlor Epoxide	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
alpha-BHC	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
beta-BHC	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
gamma-BHC (Lindane)	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
delta-BHC	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
Methoxychlor	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
Toxaphene	SW-8080A	GC/ECD	0.5 ug/L	500 ug/Kg
PCB-1016	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
PCB-1221	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
PCB-1232	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
PCB-1242	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
PCB-1248	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
PCB-1254	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
PCB-1260	SW-8080A	GC/ECD	0.2 ug/L	500 ug/Kg
Total Petroleum Hydrocarbons	EPA 418.1	IR	2.0 mg/L	10 mg/Kg
Total Petroleum Hydrocarbons (Diesel Range Organics)	SW-8015B	GC	0.1 mg/L	4.0 mg/Kg

Table 9.4. Continued

Parameter	Method Reference	Method Description	Reporting Limit Aqueous	Reporting Limit Non-Aqueous
Total Petroleum Hydrocarbons (Gasoline Range Organics)	SW-8015A Modified/SW-8015B	GC	0.1 mg/L	0.5 mg/Kg
HPLC - Polynuclear Aromatic Hydrocarbons				
Napthalene	SW-8310	HPLC	2.0 ug/L	200 ug/Kg
Acenaphthylene	SW-8310	HPLC	1.0 ug/L	100 ug/Kg
Acenaphthene	SW-8310	HPLC	1.0 ug/L	100 ug/Kg
Fluorene	SW-8310	HPLC	1.0 ug/L	100 ug/Kg
Phenanthrene	SW-8310	HPLC	1.0 ug/L	100 ug/Kg
Anthracene	SW-8310	HPLC	2.0 ug/L	100 ug/Kg
Fluoranthene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg
Pyrene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg
Benzo(a)anthracene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg
Chrysene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg
Benzo(b)fluoranthene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg
Benzo(k)fluoranthene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg
Benzo(a)pyrene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg
Dibenz(ah)anthracene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg
Benzo(ghi)perylene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg
Indeno(1,2,3-cd)pyrene	SW-8310	HPLC	0.2 ug/L	20 ug/Kg

Table 9.5. Analytical Methods and Reporting Limits - Misc.

Parameter	Method Reference	Method Description	Reporting Limit	
			Aqueous	Non-Aqueous
Acidity	EPA-305.2	Titration	10. mg/L	NA
1,2-Dibromo-3-chloropropane	EPA-504.1	GC	0.02 ug/L	NA
Ethylene dibromide	EPA-504.1	GC	0.02 ug/L	NA

10. DATA REDUCTION, VALIDATION AND REPORTING

10.1 Data Reduction

All analytical data are reduced to the appropriate concentration units as specified by the method. The analyst will reduce the data taking into account any and all factors such as dilution, percent solid, sample weight or volume and reagent normality. Blank correction will be applied only when required by the method.

10.2 Data Validation

Data validation is the process by which data is accepted or rejected based on pre-determined criteria. TestAmerica does not provide data validation services.

10.3 Data Verification

10.3.1. Data is evaluated based on the following broad range of criteria:

- Proper sample collection, storage and holding time.
- Use of standard operating procedures or other approved analytical procedures.
- Use of properly operating and calibrated instruments.
- Successful analysis of appropriate quality indicators.

10.3.2. All data will be evaluated and verified prior to being released for reporting purposes to the TestAmerica Project Management team. The persons evaluating the data will have sufficient knowledge of the technical work to identify questionable values. All raw data and pertinent record are maintained for a period of 7 years for non-potable data and 10 years for potable data. as part of the Voluntary Action Program (VAP) requirements, all documents prepared or acquired in connection with a voluntary action will be retained for a period of 10 years from the date the analyses were submitted to a certified professional.

All analytical data will be verified for completeness of Quality Control Indicator requirements, and will be spot checked for completeness. This verification will be performed by a competent analyst or the area supervisor.

After an analyst completes training on a parameter, and passes a PE sample, he/she will be permitted to perform self verification of data using specific forms designed for this purpose.

Data which is determined to be of questionable quality, either due to reasons initiating from the laboratory or concerns voiced by the client, will be reviewed by a member of the laboratory management staff. Clients will be informed of any and all data which does not meet the full Quality Control requirements as outlined in the various standard operating procedures.

10.3.3. The laboratory will use the Intra-Laboratory Notification form, Figure 10.2, to communicate any quality issues or special circumstances (i.e. especially bad matrix, holding time issues, etc.) to various members of the laboratory. The Re-Evaluation Request form, Figure 10.3, is used by the Project Managers to request a re-evaluation of a sample, describing the required action(s) to take and the sample number(s) in question. Response information such as the reason for the difference noted, problem corrected, and the type of subsequent action necessary is collected. These two forms are retained in respective project files.

The Intra-Laboratory Notification form is also used by members of the laboratory staff to communicate either internal complaints, or complaints from customers, to members of the management in order that they may be examined and resolved.

10.4 Data Reporting

Analytical results will be reported in a manner acceptable to the client. All reports will be assembled and approved by the Project Management team and delivered to the client within the time period agreed upon by the client and the laboratory. Data is generally reported at the limit of quantitation (LOQ) (Reporting Limit = LOQ). The LOQ is determined for most analytes by performing a method detection limit (MDL) study. The protocol used to determine the MDL is found in 40 CFR Part 136 Appendix B. Analytical methods and reporting limits for analytes are listed in the Tables in Section 9.

Additional data required by the customer, such as operating conditions, quality control data, method detection limits (MDLs), recommendations or problems will be reported by the Project Management team.

Figure 10.1 shows the analytical data review and reporting scheme utilized by TestAmerica-Dayton.

Figure 10.1. Analytical Data Review and Reporting Scheme

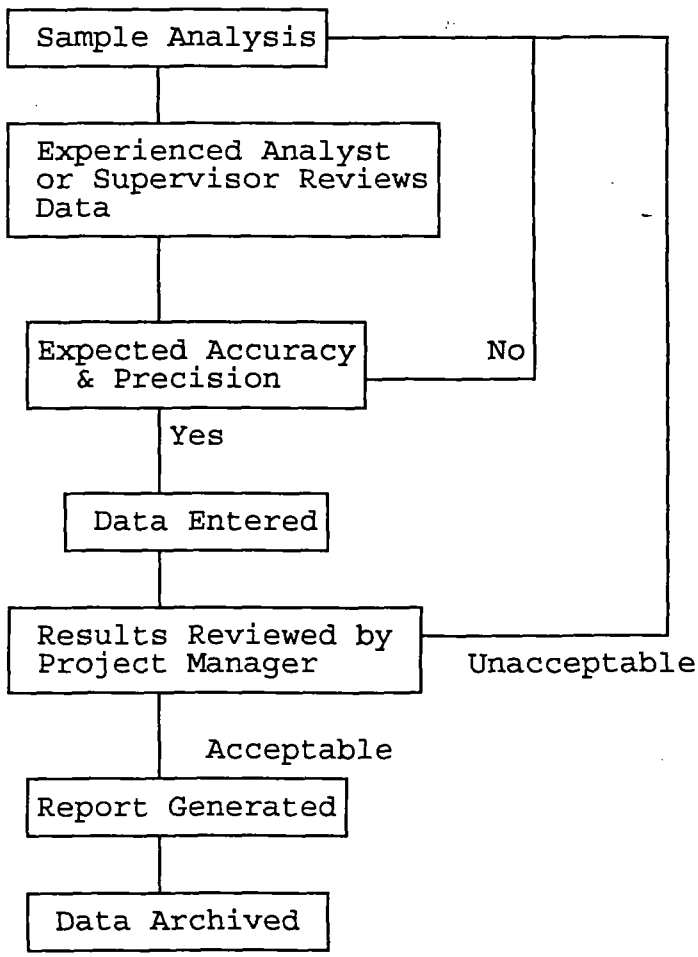


Figure 10.2. Intra-Laboratory Notification Form

INTRA-LABORATORY NOTIFICATION FORM

DATE INITIATED:_____

SAMPLE NUMBER(S):_____

PARAMETER:_____ DEPARTMENT:_____

CLIENT:_____ SUPERVISOR:_____

DEVIATION/CONCERN:_____

_____

_____

_____

_____

ACTION RECOMMENDED:

_____

_____

_____

_____

CLIENT CONTACT YES_____ NO_____

CONTACT NAME _____ DATE:_____

COMMENTS:_____

_____

_____

_____

_____

_____

_____ PROJECT MANAGER
_____ LABORATORY MANAGER
_____ DIVISION MANAGER
_____ QA/QC COORDINATOR

Figure 10.3. Re-Evaluation Request Form

RE-EVALUATION REQUEST FORM

DEPARTMENT:_____ JOB NUMBER:_____

PARAMETER:_____ CLIENT:_____

DUE DATE:_____ REQUESTED BY:_____

DATE COMPLETE:_____ REQUEST DATE:_____

SAMPLE I.D.	ORIGINAL RESULT	RER RESULT	EXPLANATION

ACTION REQUESTED:

_____ CHECK CALCULATION
_____ CHECK QC
_____ CHECK DATA ENTRY
_____ REPEAT ANALYSIS
_____ OTHER _____

REASON FOR REQUEST: _____

_____

_____

_____

ACTION TAKEN:

_____ CONTACTED CLIENT
_____ NO ACTION NEEDED
_____ ENTERED NEW RESULTS
_____ ISSUED CORRECTED REPORT
_____ OTHER _____

ROUTING:

_____ DEPT. SUPERVISOR
_____ DATA REVIEW AND APPROVAL
_____ PROJECT MANAGER
_____ QA/QC OFFICER
_____ LAB MANAGER

11. INTERNAL QUALITY CONTROL AND QUALITY ASSURANCE

11.1 Internal Quality Control

Internal quality control makes use of several types of QC samples to monitor the performance of the measurement process. Quality control checks are analyzed to ensure the generation of accurate and valid data on client samples. Please refer to Section 5 for control limits for the following QC samples. For information concerning preparation, storage and shelf life of the various Quality Control Indicators (QCI), please refer to the specific parameter SOP.

11.1.1 Blank Samples

Blank samples are analyzed to assess the extent (if any) of contamination due to the method, transit or storage. Blank samples related to field sampling are defined in Section 6. These blanks will be supplied by TestAmerica based on the data quality objectives of the project.

Blank samples which are performed with analyses include:

Method Blank The method blank is prepared just like a sample. The method blank is analyzed with samples which are processed at the same time as the blank to assess the extent of contamination obtained during the preparation process.

Solvent/Reagent Blank The reagent blank is prepared from the same lot of solvent or reagent used in the analysis. It is used to assess the background of solvents/reagents.

11.1.2 Surrogate Compounds

Surrogates are known concentrations of compounds which are added to every blank, sample, matrix spike, matrix spike duplicate and standard in order to evaluate the analytical efficiency of the method in individual sample matrices. The surrogate compounds are chemically similar to the target compounds. Surrogates are utilized based on method requirements.

11.1.3 Calibration Verification

Verification samples are analyzed during each run to assure that the method and/or instrument is properly calibrated and that calibration is maintained throughout the analytical run. Calibration verification standards include:

Initial Calibration Verification (ICV) A standard which is analyzed from a source different from those used for calibration to check the validity of the initial calibration curve. If the ICV does not pass QC criteria, the ICV is re-analyzed. If the ICV still fails QC criteria, analysis is ended, the problem is investigated, and the instrument is re-calibrated. If an ICV is used

in place of a CCV, it must meet or exceed the quality control requirements of the CCV.

Continuing Calibration Verification (CCV) A standard which is analyzed during the analytical run to confirm calibration. CCVs must meet the quality control requirements listed within the specific method. All client samples must be bracketed by acceptable CCVs.

11.1.4 Internal Standards

Internal standards are compounds which are added to every standard, blank, matrix spike, matrix spike duplicate, and sample at a known concentration prior to the analysis. The internal standards are used as the basis for quantitation of the target compounds. The utilization and recovery of the internal standards must meet method-specific guidelines. If control limits cannot be met, the sample(s) are re-analyzed. If samples cannot be re-analyzed due to limited sample volume or holding time issues, the results are flagged and the client is notified.

11.1.5 Spiked Samples

The laboratory analyzes samples which have been fortified, or spiked, with known concentrations of target analytes. Spiked samples are analyzed for a variety of reasons, and include:

Matrix Spike/Matrix Duplicate (MS/MSD) Two aliquots of sample are spiked with the analyte(s) and the recovery is determined. The matrix spike (MS) recovery indicates the presence or absence of matrix interferences, and the duplicate sample analysis (MSD) is carried out to verify precision.

Analytical Spike (AS) An aliquot of digested sample or sample into which a known amount of compound is added. The analytical spike is analyzed immediately and the recovery is calculated in order to assess the matrix effect on the analytical system.

Laboratory Control Sample (LCS) A control sample of known composition. Control samples are analyzed using the same sample preparation reagents and analytical methods as employed for samples in order to verify that the preparation and analysis methods are in control.

11.1.6 Duplicate Samples

A duplicate sample is a second aliquot of a sample which is carried through sample preparation and analysis procedures to verify the precision of the analytical method for that matrix.

11.2 Reagent and Standards Quality Control

Reagents used in the laboratory are of analytical reagent grade or higher purity. Reagent lots are checked by the analysis of reagent blanks. A reagent is labeled at the time of receipt with the date received, who received it, expiration date, manufacturer's lot number and date opened.

Material Safety Data (MSDS) are on file for all hazardous chemicals and available to all analysts. Reagents are stored in a designated reagent storage area. As appropriate, smaller quantities are stored in ventilated solvent cabinets in the laboratories and in accordance with the Material Safety Data Sheet (MSDS) storage requirements.

Records are maintained for all standards. All standards are logged into the appropriate standards logbooks which contain records of manufacturer, expiration of the standard and concentration (or purity).

11.3 Performance Evaluation Samples

Standard Reference Materials (SRMs) or any other appropriate known concentrates are analyzed on a routine basis as a quality control check. These samples are analyzed along with regular samples in the normal laboratory routine. The analyst compares the results with the known values and with the acceptance criteria outlined in Section 5. Performance Evaluation (PE) samples are utilized to document analyst training and to verify that analytical systems remain in control.

11.4 Internal Quality Assurance

To monitor quality, the following actions are periodically taken by the Division/Operations Manager(s) and Quality Assurance Coordinator:

11.4.1 QC Single or Double Blind Samples

Samples which are known to be PE samples (single blind) and samples which are not known to be PE samples (double blind) are prepared by the QA Coordinator on a periodic basis or when requested by Division/Project Manager(s) to assess analysis. These samples are analyzed and the results are reported to the divisional QA Coordinator. The QA Coordinator then reviews the analytical data and determines if corrective action is needed.

11.4.2 Internal Audits

Periodically, internal audits are conducted by the divisional QA Coordinator to evaluate systems and performance as described in Section 12.

12. SYSTEM AND PERFORMANCE AUDITS

12.1 Performance Audits

Performance audits provide a systematic check of laboratory data quality and measurement systems. For maximum usefulness two types of performance evaluation samples are employed, single blind and double blind.

Single-blind A sample which is known by all concerned to be a PE sample and only the values are unknown. The results of these samples are useful in determining technical systematic problems within the operating group.

Double-blind A sample that appears to be a client sample; its identity and values are both unknown to the laboratory. Double-blind samples are useful in identifying technical systematic problems, random analytical problems, and non-technical systematic problems.

TestAmerica Dayton routinely participates in single-blind laboratory performance evaluations.

12.2 Systems Audits

A system audit is an evaluation of a laboratory's quality assurance practices and operating procedures. This audit consists of an on-site review of the laboratory's quality assurance systems and its physical facilities. In addition to internal audits performed by the QA Coordinator, periodic systems audits are performed by the Director of Data Quality. Findings of these audits are reported in writing to the Division Manager and the Corporate Office. If appropriate, corrective action is requested and the corrective action taken is documented. Clients and regulatory agencies may also perform system audits.

12.2.1 The system audit may include any of the following:

- Personnel, facilities and equipment;
- Chain-of-custody procedures;
- Sample tracking procedures;
- Instrument calibration and maintenance;
- Standards preparation and verification;
- Sample preparation procedures;
- Analytical procedures;
- Quality Control procedures;

- Data handling procedures;
- Training records;
- Documentation; and
- Document control procedures.

13. PREVENTATIVE MAINTENANCE PROCEDURES AND SCHEDULES

13.1 Preventative Maintenance Program

TestAmerica follows a well-defined program to prevent the failure of laboratory equipment or instrumentation during use. This program of preventative maintenance helps to avoid delays due to instrument downtime. Adequate supplies of spare parts such as GC columns, syringes, septa, injection port liners and electronic parts are maintained in the laboratory.

Routine preventative maintenance procedures such as lubrication, source cleaning, detector cleaning and the frequency of such maintenance are performed according to the procedures outlined in the manufacturer's manual. Chromatographic carrier gas purification traps, injection port liners and septa are cleaned or replaced on a regular basis. Precision and accuracy data are examined for trends and excursions beyond established control limits to determine evidence of instrument malfunction. Maintenance must be performed by laboratory analysts when there is evidence of degradation of peak resolution, a shift in the calibration curves, loss of sensitivity, or failure to meet one of the quality control criteria.

The preventative maintenance performed on major laboratory instrumentation is summarized in Table 13.1. Instrument logbooks containing usage, calibration, maintenance and repair records are kept in the laboratories at all times.

13.2 Equipment Malfunction

In the event of equipment malfunction that cannot be resolved within two working days, service shall be obtained from the instrument vendor or manufacturer, if such a service agreement exists or can be tendered. If on-site service in the laboratory is unavailable, arrangements shall be expedited to have the instrument shipped to the manufacturer for repair. Back-up instruments which have been approved for the analysis shall perform the analysis normally carried out by the malfunctioning instrument, if feasible. If back-up is not available and the analysis cannot be carried out within the needed time frame, the samples shall be subcontracted to another approved laboratory to carry out the analysis.

Table 13.1. Maintenance Procedures for Major Instrumentation

Instrumentation	Maintenance Procedure	Spare Parts
Gas Chromatograph/Mass Spectrometer	1. Replace pump oil as needed. 2. Change septa as needed. 3. Change gas line dryers as needed. 4. Clean source as needed. 5. Replace electron multiplier as needed. 6. Injection port cleaning as needed.	Syringe Septa Various electronic components Plumbing supplies Injection port liners
Gas Chromatograph	1. Change septa as needed. 2. Clean gas line dryers as needed. 3. Change syringes on autosamplers as needed. 4. Leak check when installing columns 5. Injection port cleaning as needed. 6. Check inlet system for residue buildup periodically.	Syringe Septa Various electronic components Plumbing supplies Injection port liners
Purge and Trap Sample Concentrator	1. Replace trap as needed. 2. Decontaminate system as required by blank analysis. 3. Check system for leaks.	Traps Various electronic components Plumbing supplies
Graphite Furnace Atomic Absorption Spectrophotometer	1. Change graphite contact rings as needed. 2. Clean quartz windows as needed. 4. Change tubes as needed.	Contact rings Tubes

Table 13.1 Continued...

Instrumentation	Maintenance Procedure	Spare Parts
Inductively Coupled Plasma Spectrometer	1. Change sample rinse lines. 2. Clean nebulizer components, torch assembly and spray chamber. 3. Clean filters. 4. Clean mirrors.	Nebulizer components Torch assembly Pump tubing and sample probe
Inductively Coupled Plasma - Mass Spectrometer	1. Change pump tubing as needed. 2. Clean nebulizer components, torch assembly and spray chamber. 3. Clean sampler and skimmer cones. 4. Change roughing pump oil.	Spare electrode Pump tubing Nebulizer components Torch assembly Spray chamber assembly Sampler and skimmer cones Pump oil
pH/Conductivity Meter	1. Clean electrodes as needed. 2. Refill electrodes as needed.	Filling solution
Balance	1. Check level of balance daily. 2. Clean balance pan daily. 3. Weigh and record a known mass daily. 4. Calibrate and clean balance monthly. 5. Outside service on all balances annually.	
Wet Chemistry Auto Analyzer	1. Recharge/replace coils as needed. 2. Clean/replace flow cells as needed. 3. Change pump tubes and gas line as needed. 4. Clean sampling pivot head and replace probe as needed.	Glass connectors Tubing Glass coils (5 and 20 turn) Cd reduction coils

Table 13.1. Continued...

Instrumentation	Maintenance Procedure	Spare Parts
Total Organic Carbon Analyzer (TOC)	1. Change copper/tin scrubber as needed. 2. Clean combustion tube as needed. 3. Replace permeation dryer when discolored. 4. Check and clean IC chamber, TC inlet valve, IC inlet valve, bottom connector and ASM sample loop as needed.	Septa Sample tip Copper/tin particles
Mercury Analyzer	1. Change drying tube daily. 2. Change pump tubing weekly. 3. Clean optical cell as needed. 4. Clean liquid/gas separator as needed.	Assorted Tubing Hg Lamp Liquid/Gas Separator Assembly

14. SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY AND COMPLETENESS, AND OTHER QUALITY CONTROL INDICATORS

14.1 Precision

Precision is a measure of the degree of agreement between repeated measurements of the same parameter under prescribed, similar conditions. Analytical precision will be monitored using results from duplicate analyses. Analytical precision goals expressed as relative percent difference (RPD), are presented in Section 5. The RPD is calculated as follows:

$$RPD = \frac{\text{Absolute Value } (D1) - (D2)}{(D1 + D2)/2} \times 100$$

where,

RPD is the relative percent difference

D1 is the first duplicate value (percent recovery); and

D2 is the second duplicate value (percent recovery).

14.2 Accuracy

Accuracy is a measure of the degree of agreement between an analyzed value and the true or accepted reference value. The accuracy of a measured value is expressed as a percent of the expected or known value. In the laboratory, accuracy will be evaluated by comparing the recoveries of parameters of interest against criteria outlined in Section 5, through the use of quality control reference samples or reference materials. The recovery of a compound will be defined as:

$$\%R = \frac{(SSR - SR)}{S} \times 100$$

where,

%R is percent recovery

SSR is the spiked sample result

SR is the sample result; and

S is the spike concentration

14.3 Completeness

Completeness is a measure of the amount of valid data obtained from the samples received. It is defined in terms of a percentage of the number of valid measurements expected. Ideally, every sample will generate all of the valid measurements expected. Realistically, some samples may be lost in laboratory accidents or some data may be deemed questionable based on internal quality control criteria. Such instances will be documented and communicated to the client in a narrative section of the report.

Completeness also implies the ability of the final report to answer the client's questions. TestAmerica will have personnel available to discuss analytical reports with clients. Every attempt will be made by TestAmerica to achieve 100% completeness on analytical parameters. All judgements of completeness will be determined by the client. Percent completeness is calculated as follows:

$$\% C = 100 * \frac{V}{n}$$

where,

% C = Percent Completeness
V = number of results judged to be valid
n = total number of results

14.4. Other Quality Control Indicators (QCI)

14.4.1. Method Detection Limit (MDL) Studies

Method Detection Limit Studies are calculated using between seven and ten replicates. The equation is as follows:

MDL = SD * Student's T Value

where,

SD = the Standard Deviation of the seven to ten replicates

Student's T Value = value based on the number of replicates (see below):

Number of Replicates	Student's T Value
10	2.821
9	2.896
8	2.998
7	3.143

For additional information, please refer to the SOP for detection limit studies.

14.4.2. Statistically Based Control Limits

14.4.2.1. Statistically based control limits are calculated using a minimum of twenty data points. The individual limits are calculated as follows:

Upper Control Limit (UCL) = Mean + 3SD
Upper Warning Limit (UWL) = Mean + 2SD
Lower Warning Limit (LWL) = Mean - 2SD
Upper Control Limit (LCL) = Mean - 3SD

where,

Mean = the Average of the replicates
SD = The Standard Deviation of the replicates

14.4.2.2. Trend Analysis, using the control limits, is a useful tool in helping to identify when a procedure is out of control or approaching an out of control situation. Some items or trends to look for and what they may indicate are as follows:

ITEM OR TREND	POSSIBLE INDICATION
Any point outside of the control limits	Out of control
7 consecutive points increasing or decreasing	Approaching out of control situation
Cycles or reoccurring patterns	There is a variable in the procedure that is affecting results
7 data points on the same side of the center line	Something in the procedure has changed and is affecting results
2 consecutive points within warning limits	Procedure is out of control and the problem must be corrected

15. CORRECTIVE ACTION

An important part of any quality assurance program is a well-defined, effective policy for correcting quality problems. NET maintains a corrective action system which operates under the direction of the Division Manager and Quality Assurance Coordinator. While the entire quality assurance program is designed to avoid problems, it also serves to identify and correct those that occur. Usually these quality problems fall into two categories: immediate corrective action or long-term corrective action.

15.1 Immediate Corrective Action

Specific quality control procedures are designed to help analysts detect the need for corrective action. Often, an analyst's experience will be most valuable in identifying abnormal analyses or malfunctioning equipment. Immediate corrective action may be taken. Such actions should be noted in laboratory notebooks but no other formal documentation is required unless the corrective action taken fails to correct the problem.

15.2 Long Term Corrective Action

The need for formal corrective action may be identified by performance on routine QC samples, control chart trends, or as a result of a performance or systems audit. Any quality problem which cannot be solved by immediate corrective action falls into this category. The division QA Coordinator is responsible for managing the corrective action process and communicating the status of corrective action progress to the Division Manager.

The QA Coordinator may, with the support of the Division Manager, delegate responsibilities for investigating problems and implementing solutions to appropriate operational groups or individuals. Involvement of the analyst and supervisor of the area concerned is crucial to the effectiveness of the corrective action process. It is the responsibility of analysts and supervisors to write corrective action reports, and it is the responsibility of the QA Coordinator to maintain the corrective action reports.

15.2.1. The essential steps in the closed loop corrective action system are:

1. Identification of the problem

2. Assignment of responsibility for investigating the problem

3. Determination of the cause of the problem through investigation

4. Formulation of a corrective action plan

5. Assignment of responsibility for implementation of the corrective action plan

6. Monitoring the effectiveness of the corrective action plan

7. Verifying the elimination of the problem

8. Documenting the process involved

15.3 Corrective Action Reports

Corrective Action Reports are formal documentation of long term corrective action taken at the Division. These reports are required for "Unacceptable" results on Performance Evaluation (PE) studies.

15.3.1 Steps Required to Complete a Corrective Action Report

1. Notification of acceptability of results.

2. Quality Assurance Coordinator informs appropriate analyst, supervisor, and Project Managers of unacceptable parameters requiring a Corrective Action Report (CAR).

3. Analyst determines, through careful and thorough consideration, possible sources of the problem.

4. Analyst with the help of the Supervisor, if necessary, identifies the assignable cause of the problem and documents this on the CAR form.

5. Along with identification of the problem, the specific steps taken to correct the problem are documented on the CAR form.

6. The analyst reviews the CAR with the Supervisor, the QAC, the Division Manager and/or the Project Manager to ensure that the assignable cause is understood and agreed upon.

7. If appropriate, after the problem has been identified and corrected, a blind performance evaluation sample is submitted by the QA Coordinator.

8. Successful completion of the blind performance sample will demonstrate that the analysis is in control. Unsuccessful completion of the blind performance sample will indicate that appropriate corrective action has not taken place and the process must start over with analyst identification of the problem.

9. After successful completion of the corrective action

process, the CAR is reviewed and signed by the QA Coordinator and the Division Manager.

The QA Coordinator verifies corrective action is maintained in the laboratory by reviewing analytes with CARs during his/her routine systems audits.

16.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

16.1 Quality Assurance Coordinator - Reports to Management

The Quality Assurance Coordinator is responsible for reporting to management on the effectiveness of the Quality Assurance Plan. A monthly summary of quality-related issues is prepared and submitted to the Director of Data Quality, the Division Manager, and other appropriate personnel.

16.2.1. The monthly quality assurance report topics are:

A. Any Key Issues

B. SOPs

C. Corrective Action Reports

D. MDLs

E. Audits and Client Visits

F. Performance Evaluation Samples

G. Certification, Accreditation and Contract Approval

H. Training

G. Other

16.2 Quality Systems Management Review

It is our policy for the senior divisional management team to conduct an annual review of its quality systems to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements.

This review uses information generated during the preceding year to assess the "big picture" by ensuring that routine quality actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review should continually keep the quality systems current and effective, therefore, the annual review is a formal senior management process to review specific existing documentation.

16.3.1. The significant issues from the following documentation should be summarized by the Quality Assurance Coordinator prior to the review meeting:

- matters arising from the previous annual review;
- prior monthly Quality Assurance Reports, including information on:

- internal systems audit summaries and corrective actions;
- reports from audits by clients or third-party assessments;
- results of performance evaluation samples, including corrective actions implemented;
- results of internal quality checks;
- certification / accreditation issues;
- methods or SOP issues;
- staff training;
- prior Re-Evaluation Request forms;

- minutes from prior data quality management and staff meetings;
- minutes from prior Senior Management Team meetings, including:
  - adequacy of staff, equipment and facility resources;
  - future plans for resources and testing capability and capacity;
- prior Customer Service / Business Development meeting information and prior Inter -Laboratory notification forms that involves data quality issues or client complaints.

The annual review includes the previous 12 months and can occur anytime during the calendar year to best meet the needs of the division. Based on the annual review, a report is generated by the Quality Assurance Coordinator for distribution to the Division's Senior Management Team and the Director of Data Quality that includes:

- when the review occurred and who participated;
- a reference to the existing data quality related documents and topics that were reviewed;
- what quality systems changes or improvements will be made as a results of the review;
- an implementation schedule for the changes.

The Divisional Quality Assurance Plan should be revised at this time to reflect any significant changes made to the quality systems.

APPENDIX 1. ANALYTICAL EQUIPMENT LIST

The Dayton Division of TestAmerica maintains a full range of modern, state-of-the-art equipment and instrumentation. Additional equipment and instrumentation is available at other TestAmerica laboratories located throughout the United States.

Listings of major analytical instrumentation and equipment for both the laboratory and field operations are found in Tables 1 - 5 of this Appendix.

Table 1. Equipment List for Metals Department

Group : Graphite Furnace
- Atomic Absorption unit: Perkin Elmer SIMA 6000 Simultaneous graphite furnace with Zeeman correction and autosampler
- Data System: Dell Optiplex GS
- Printer: HP Laserjet 4

Group : Inductively Coupled Plasma Spectrometer (ICP)
- ICP Spectrometer: TJA Model 36
- Autosampler: Model AS 300
- Data System: NPC 486, ThermoSPEC software
- Printer: Epson LQ 570+

Group : Automated Cold Vapor (Mercury)
- Leeman Labs Model PS200 with autosampler
- Printer: GSX-190 Citizen
- Data System: IBM PC with Leeman PS200 software

Group : Inductively Coupled Plasma - Mass Spectrometer (ICP-MS)
- ICP-MS: Perkin-Elmer ELAN 6000
- Autosampler: Perkin-Elmer AS 91
- Data System: Dell Optiplex 6xi
- Printer: HP Laserjet 4+

Unit : Metal Preparation Laboratory
Balance: Mettler AG 204

Table 2. Equipment List for Wet Chemistry Department

Description	Manufacturer	Model
Auto Analyzer with (2) Autosampler	Bran-Luebbe	Traacs 800
TOC Analyzer with Autosampler	Tekmar/Dohrmann	DC-190
Spectrophotometer	Milton Roy	301
Spectrophotometer	Milton Roy	501
Ion Analyzer	Orion Research	901
pH Meter	Orion Research	SA 520
pH Meter	Accumet	20
pH Meter	Orion Research	601 A
Turbidimeter	Hach	2100 AN
Flash Point Analyzer	Precision Scientific	
Oxygen Meter	YSI Scientific	5000
ZHE Extractors	Millipore	
Balance	Mettler	HK 160
Balance	Mettler	AE 160
Muffle Furnace	Lindberg	51828
Vacuum Oven	Fisher Scientific	281
Orbital Shaker	Labline	3590
Rapidstill II	Labconco	
Midi CN Distillers (2)	Labcrest	

Table 2. Continued...

Description	Manufacturer	Model
Ovens (4)	Blue M / VWR	
Incubators (3)	Precision/Unitherm/Puffer Hubbard	
Water Bath	Precision	180
RADIOLOGY		
Alpha/Beta/Gamma System with Autosampler (3) and NaI Detector (3)	Canberra	2404
BACTERIOLOGY		
Autoclave	Amsco	57 CR
Microscope	American Optical	110
Colony Counter	American Optical	3352
Incubator	VWR	3020
Water Bath	Blue M	MW 1120A-1
Bacti-Cinerator II	Scientific Products	Cat. No B9753

Table 3. Equipment List for GC/MS Department

Unit: GC/MS-A (Volatiles)
- GC- Hewlett Packard Model 5890
- MS- Hewlett Packard Model 5970
- Liquid Sample Concentrator: Tekmar Model LSC-3000
- Autosampler: Archon Model 5100
- Data System: Hewlett Packard Vectra PC with Enviroquant software
- Printer: Hewlett Packerd 4si

Unit: GC/MS-B (Semi-Volatiles)
- MS- Hewlett Packard Model 5970
- Autosampler: Hewlett Packard Model 7673A
- Data System: Hewlett Packard Vectra PC with Enviroquant software

Unit: GC/MS-C (Volatiles)
- GC- Hewlett Packard Model 5890
- MS- Hewlett Packard Model 5970A
- Liquid Sample Concentrator: Tekmar Model LSC-3000
- Autosampler: Archon Model 5100
- Data System: Hewlett Packard Vectra PC with Enviroquant software
- Hewlett Packard 4si

Unit: GC/MS-D (Volatiles)
- GC- Hewlett Packard Model 5890
- MS- Hewlett Packard Model 5970
- Liquid Sample Concentrator: Tekmar Model LSC 2000
- Autosampler: Tekmar Model ALS 2050
- Data System: Hewlett Packard Vectra PC with Enviroquant software

Unit: GC/MS-E (Semi-Volatiles)
- GC- Hewlett Packard Model 5890 Series II
- MS- Hewlett Packard Model 5970
- Autosampler: Hewlett Packard Model 7673A
- Data System: Hewlett Packard Vectra PC with Enviroquant software
- Hewlett Packard 4si

Unit: GC/MS-F (Semi-Volatiles)
- GC- Hewlett Packard Model 5890
- MS- Hewlett Packard Model 5970
- Autosampler: Hewlett Packard Model 7673A
- Data System: Hewlett Packard Vectra PC with Enviroquant software
- Hewlett Packard 4si

Unit: Balance: Mettler BB 330

Table 4. Equipment List for GC Department

Unit: GC-1
- GC- Hewlett Packard Model 5880A
- Autosampler: Hewlett Packard Model 7671A
- Detector: Flame Ionization
- Integrator(2): Hewlett Packard

Unit: GC-2
- GC- Hewlett Packard Model 5890
- Autosampler : Hewlett Packard Model 7673A
- Detector 1 - ECD
- Detector 2 - ECD
- Data System: Hewlett Packard Vectra PC with Enviroquant Software

Unit: GC-3
- GC - Hewlett Packard Model 5890, Series II
- Detector - Dual ECDs
- Data System: Hewlett Packard Vectra PC with Enviroquant Software
- Printer: Hewlett Packard

Unit: GC-4
- GC - Hewlett Packard Model 5890, Series II
- Detector - Dual PIDs, FID
- Autosampler - Tekmar 2000 Conc., Archon autosampler
- Data System: Hewlett Packard Vectra PC with Enviroquant Software
- Printer: Hewlett Packard

Unit: GC-5
- GC- Hewlett Packard Model 5890
- Autosampler : Hewlett Packard Model 7673A
- Detector 1 - ECD
- Detector 2 - ECD
- Data System: Hewlett Packard Vectra PC with Enviroquant Software
- Printer: Hewlett Packard IIIsi

Unit: GC-6
- GC- Hewlett Packard Model 5890
- Autosampler (2): Hewlett Packard Model 7673A
- Detector 1 - ECD
- Detector 2 - ECD
- Data System: Hewlett Packard Vectra PC with Enviroquant Software
- Printer: Hewlett Packard IIIsi

Table 4. Equipment List for GC Department, continued

Unit: GC-7
- GC- Hewlett Packard Model 5890
- Auto Sampler (2): Hewlett Packard Model 7673A
- Detector: Dual PIDs; Trimetrics
- Detector: Dual FIDs; Hewlett Packard
- Data System: Hewlett Packard Vectra PC with Enviroquant Software
- Printer: Hewlett Packard IIIsi

Unit: HPLC
- Liquid Chromatography Unit: Hewlett Packard Model 1050
- Flourescence Detector : Hewlett Packard 1046A
- Data System: Hewlett Packard Vectra PC with Chemstation Software
- Printer: Hewlett Packard II

Unit: FT-IR
- FT-IR: Perkin Elmer 1600 Series
- Printer: Okidata Microline 391

Unit: Balance
- Mettler Model AE 163
- Mettler Model PE 360

Unit: Nitrogen sample concentration unit (2)
- Labconco Rapidvap

Table 5. Equipment List for Field Services Department

Description	Manufacturer	Model
Autosamplers (7)	ISCO	2700
Autosamplers (2)	ISCO	3700
Autosamplers (1)	ISCO	2100
Flow Meters (4)	ISCO	1870
Flow Meters (1)	ISCO	3210
Flow Meter (3)	ISCO	3230
Conductivity Meter	YSI	33
pH Meter (2)	Hanna	9025
Residual Chlorine Kit	Hach	CN66
Water Level Indicator	SINCO	51405301
Pressure Filtration Device	Geotech	0856
Confined Space Entry Equipment		
Ventilator	Air Systems International	SVB-G8
Winch	Miller Equipment	50 G
Gas Monitors	Industrial Scientific	HMX 271
Field Sampling Vehicles (4)	Chevy and GMC	
4 Inch Well Pump	Suburban	P051-2W
2 Inch Well Pump	Grandfos	Rediflo 2
Electrical Generator	Pincor	RF-30HM5
Power Auger	Tecumseh Engines	21
2 Inch Teflon Bailer	Modern Industrial Plastics	GWE-300

K.03
8/1/97

TestAmerica-Dayton
Requested Albion QAPP Changes

VOLUME 3 OF 3
APPENDICES (CONTINUED)

REMEDIAL ACTION WORKPLAN ALBION-SHERIDAN TOWNSHIP LANDFILL CALHOUN COUNTY, MI

Prepared for
Cooper Industries
Houston, Texas

and

Corning, Inc.
Corning, New York

August, 1997

Woodward-Clyde

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APPENDIX D
FINAL REPORT

QUALITY ASSURANCE PROJECT PLAN

ALBION-SHERIDAN TOWNSHIP LANDFILL
CALHOUN COUNTY, MI

Prepared for
Cooper Industries
Houston, Texas

and

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Corning, New York

August, 1997

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List of Acronyms

A	Acid Fraction (extractables)
AA	Atomic Absorption
AFR	Audit Finding Report
ARARs	Applicable or Relevant and Appropriate Requirements
BN	Base Neutral Fraction (extractables)
CCB	Continuing Calibration Blank

CCC	Continuing Calibration Compounds
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Responsibility Compensation and Liability Act
CVAA	Cold Vapor Atomic Absorption
DFTPP	Decafluorotriphenylphosphine
DL	Detection Limit
DQO	Data Quality Objectives
ECD	Electron Capture Detector
FID	Flame Ionization Detector
FSP	Field Sampling Plan
GC	Gas Chromatograph
GC/MS	Gas Chromatograph/Mass Spectrometer
GFAA	Graphite Furnace Atomic Absorption
ICP	Inductively Coupled Plasma Emission Spectrophotometer
LCS	Laboratory Control Sample
LD	Laboratory Duplicate
MCL	Maximum Concentration Level
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSA	Method of Standard Additions
ND	Not Detected
ORP	Oxidation/Reduction Potential
OVA	Organic Vapor Analyzer (Flame Ionization Detector)
PE	Performance Evaluation
PQAO	Project Quality Assurance Officer
QA	Quality Assurance
QC	Quality Control
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QAU	Quality Assurance Unit
RD/RA	Remedial Design/Remedial Action
RI/FS	Remedial Investigation/Feasibility Study

ROD	Record of Decision
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RRF	Relative Response Factors
SPC	Specific Conductivity Meter
SPCC	System Performance Calibration Compounds
SOP	Standard Operating Procedures
SVOC	Semi-Volatile Organic Compounds
SW846	"Test Methods for Evaluating Solid Waste, "Third Edition, September 1986 and approved updates.
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds
WP	Work Plan
%C	Percent Completeness
%D	Percent Difference
%R	Percent REcovery
%RSD	Percent Relative Standard Deviation

REMEDIAL ACTION (RA)
QUALITY ASSURANCE PROJECT PLAN (QAPP)
ALBION-SHERIDAN TOWNSHIP LANDFILL

CALHOUN COUNTY, MICHIGAN
PREPARED BY: WOODWARD-CLYDE CONSULTANTS

Approved by: _____ _____

Jon Peterson, Remedial Project Manager — Date

U.S. EPA - Region V

Approved by: _____ _____

Superfund Quality Assurance Reviewer — Date

U.S. EPA - Region V

Approved by: _____ _____

Project Manager — Date

O&M Contractor

Approved by: _____ _____

Project QA Officer — Date

O&M Contractor

Approved by: _____ _____

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City of Albion

1.1 INTRODUCTION

The Albion-Sheridan Township Landfill Group ("Group") and Woodward-Clyde Consultants submit this Quality Assurance Project Plan (QAPP) to the United States Environmental Protection Agency (U.S. EPA), Region V, for the Remedial Action (RA) of the Albion-Sheridan Township Landfill (Site) located in Calhoun County, Michigan. The QAPP has been completed as part of the compliance requirements with the approved remedial action presented in the Record of Decision (ROD) and the Unilateral Administrative Order (UAO) for remedial design/remedial action (RD/RA), issued October 11, 1995 which took effect on December 11, 1995. The QAPP is to be used in conjunction with the following project documents:

- Operation And Maintenance Plan (O&M)
- Performance Monitoring Plan (PMP)
- Health and Safety Plan (HASP)

This QAPP describes protocols to be followed by personnel during field and laboratory sampling and analytical work. The objective of the QAPP is to provide procedures that document and ensure the precision, accuracy, completeness, and representativeness of data generated during field activities and laboratory analysis. This QAPP presents the organization, data quality objectives, functional activities and specific quality assurance (QA) and quality control (QC) activities associated with the RA activities for the Albion-Sheridan Landfill site in Calhoun County. This QAPP also describes the specific protocols which will be followed for sampling, sample handling, storage, chain of custody, and laboratory analyses.

The tasks described in this QAPP encompass all activities associated with the Operation and Maintenance (O&M) activities at the Albion-Sheridan Township Landfill Site.

1.1.1 Overall Project Objectives

The overall objective of remedial activities at the site is to implement the remedy presented in the ROD (U.S. EPA 1995). The ROD describes the remedy of the site as drum removal and construction of a cap over the landfill. The ROD states that this remedy is to reduce the risks associated with exposure to the contaminated materials on site, to eliminate or reduce migration of contaminants to the groundwater, and to reduce the risks associated with arsenic contamination in the groundwater. The ROD chose the remedial action in accordance with two threshold criteria, overall protection of human health and the environment, and compliance with the requirements of Federal and State Applicable or Relevant and Appropriate Requirements (ARARs). The ROD requires the design (RD) and implementation of the remedial action (RA) to meet the performance standards and specifications set forth in the ROD and the SOW. Performance standards shall include cleanup standards, standards of control, quality criteria and other substantive requirements, criteria or limitations including all ARARs set forth in the ROD, SOW and/or unilateral Administrative Order (UAO).

During O&M, an annual and quarterly groundwater monitoring program will be implemented as well as a landfill gas emission study to evaluate the effectiveness of the Site remedy. Six monitoring wells and seven drinking water wells will be sampled on a quarterly basis. The groundwater monitoring wells will be analyzed for field parameters, arsenic and ammonia. Field parameters include: groundwater depth/elevation before purging, temperature, pH conductivity, Eh, and dissolved oxygen. Analysis of the drinking water wells will include field parameters (less depth/elevation), Target Compound list (TCL) volatile Organic Compounds (VOCs) and 1,2-dibromo-3-chloroproprane, base / neutral and acid (BNA) extractable compounds, TAL Metals, Pesticides/PCBs, mercury, cyanide, chloride, sulfate, nitrate/nitrite and ammonia. On an annual basis, 17 monitoring wells will be sampled and submitted for analysis. The annual monitoring will be done in accordance with the SOW and consist of : 1) field parameters, and 2) chemicals of concern. Chemicals of concern will be 5 TAL chemicals (aluminum, arsenic; cobalt; manganese; and nickel), 2 TCL VOCs - benzene and vinyl chloride, and antimony, ammonia and 1,2-dibromo-3-chloropropane.

Seventeen designated monitoring wells will be sampled and analyzed for TCL organics, TAL inorganics and 1,2-dibromo-3-chloropropane to assist the EPA in meeting the requirements of Section 121(c) of CERCLA for the first five year review of the Site. Five-year review groundwater monitoring will occur approximately 50 to 52 months after approval of the Final Design.

After the groundwater analytical data from the initial year of groundwater sampling has been evaluated, analytes will be removed from the list if the provisions of the generic residential cleanup for the health based drinking water value for Public Act 307 amended, June 1995 Act 451 are met with the approval from the EPA and MDEQ. This list will be reevaluated each year upon the review of the full TCL and TAL laboratory results. A new compound may be added to the list for quarterly sampling parameters if it appears that the compound is originating from the landfill. A compound maybe dropped from the list if it is not observed during the next consecutive quarterly sampling events above the appropriate residential or industrial cleanup criteria. The quarterly and annual groundwater monitoring program are scheduled to commence following construction of the site cap (Table 1-1)

A landfill gas monitoring program will be conducted as part of the O&M monitoring activities. The objective of the gas monitoring program is to evaluate the concentrations of specific toxic pollutants under Michigan Public Act 348 and to verify that the total cancer risk level at the fence line does not exceed 1×10^{-6}. Ambient air at three selected locations (two gas vents at areas with the greatest apparent waste thickness and one downwind fenceline location) will be sampled once. These air samples will be analyzed in an off-site laboratory for a select group of VOCs. Additionally, the migration of combustible landfill gas, specifically methane, will be monitored on a quarterly basis as a percent of the Lower Explosive Limit (LEL). Direct readings of hydrogen sulfide and oxygen will also be monitored on a quarterly basis.

1.1.2 Project Status/Phase

The Group and U.S. EPA entered into a UAO for the completion of an RD/RA, which took effect on December 11, 1995. Preparation of the RD Work Plan and accompanying documents (QAPP, FSP and HASP) was the initial phase of this project. This QAPP has been primarily developed with respect to the O&M long-term groundwater and landfill gas emissions monitoring programs to assess the effectiveness of the remedial action.

This QAPP describes the O&M monitoring sampling and analyses that will be performed. As previously noted, monitoring activities during O&M will include:

- Quarterly groundwater sampling and analyses of six monitoring wells for arsenic and ammonia
- Quarterly groundwater sampling and analyses of seven drinking water wells for TCL VOCs and 1,2-dibromo-3-chloropropane, TCL BNAs, TCL pesticides/PCBs, mercury, cyanide, chloride, sulfate, nitrate/nitrite and ammonia
- Annual groundwater sampling and analysis of 12 monitoring wells for select metals (arsenic, aluminum, antimony, cobalt, manganese and nickel), select VOCs (benzene, 1,2-dibromo-3-chloropropane and vinyl chloride) and ammonia
- One time landfill gas emissions monitoring for select VOCs and quarterly monitoring for methane
- Five year review groundwater sampling and analysis of 17 monitoring wells for TCL organics and 1,2-dibromo-3-chloropropane and TAL inorganics

The results of the O&M Monitoring Program will be used to monitor the effectiveness of the remedial action and to minimize human exposure to landfill gas emissions during any phase of the remedial action.

Other additional activities that may be performed during the O&M include:

- Additional groundwater or air emissions sampling and analysis
- Refining the long term groundwater monitoring program

If these activities are added to the O&M tasks, additional addendum's to this QAPP will be submitted for approval by U.S. EPA

1.1.3 QAPP Preparation Guidelines

The QAPP has been prepared in accordance with the "Region 5 Model Superfund Quality Assurance Project Plan", dated January 1996. Other documents which have been referenced for the Albion-Sheridan Township Landfill Site RA and referenced in this QAPP include the Operation and Maintenance (O&M) Plan, Performance Monitoring Plan (PMP) and the Health and Safety Plan (HASP).

1.2 SITE/FACILITY DESCRIPTION

1.2.1 Location

The Albion-Sheridan Township Landfill is an inactive landfill located at 29975 East Erie Road approximately one mile east of Albion, Michigan on the eastern edge of Calhoun County. The landfill is approximately 18 acres in area and its boundaries are shown in figure 1 the O&M Plan.

The study area for the O&M activities includes the Site property and off-site areas immediately surrounding the Site.

1.2.2 Facility/Size And Borders

This is addressed in Section 1.1 of the O&M Plan, which is herein incorporated through reference, and in the figures which have been submitted along with the O&M Plan.

1.2.3 Topography

See Sections 1.1 of the O&M Plan for information concerning the Site's general topography.

1.2.4 Local Hydrology And Hydrogeology

See sections 2.1 and 2.2 of the O&M Plan for information concerning the Site's geology and hydrogeology.

1.3 SITE FACILITY/HISTORY

1.3.1 General History

From 1966 to 1981, the landfill was privately owned and operated by Mr. Gordon Stevick. The landfills accepted municipal refuse and industrial wastes from households and industries in the City of Albion and nearby townships. In the early 1970's, the Michigan Department of Natural Resources (MDNR) approved the landfill to accept metal plating sludges. Other materials, such as paint wastes and thinners, oil and grease, and dust, sand, and dirt containing fly ash and casting sand were also disposed of at the site. In 1980, the MDNR collected and analyzed samples of non-containerized sludges that were being disposed at the site. The sludges contained heavy metals, including chromium (250,000 mg/kg), zinc (150,000 mg/kg), nickel (1,000 mg/kg) and lead (280 mg/kg). The sludges remain buried at the Site. The landfill ceased operation in 1981.

1.3.2 Past Data Collection Activities

Investigations and/or remedial actions conducted to date include:

- 1986 - A U.S. EPA Field Investigation Team (FIT) Contractor, performed a site screening inspection for scoring the site per the Hazard Ranking System (HRS). Based on the HRS, the Site was included on the National Priorities List (NPL) and designated as a Superfund Site.
- 1988 and 1989 - Site inspections conducted by a U.S. EPA Technical Assistance Team (TAT) resulted in a 1990 removal action of approximately forty-six (46) drums containing various RCRA hazardous waste. The removal action was conducted in accordance with a Unilateral Administrative Order (UAO, March 1990).
- 1992 through 1995 - U.S. EPA conducted a Remedial Investigation/Feasibility Study (RI/FS) for the Site, pursuant to CERCLA and the National Contingency Plan.
- The FS work culminated with the U.S. EPA ROD of March 1995, which described the selection of the remedial action to be implemented at the Site.
- 1996 - WCC conducted a Pre-Design Studies which included monitoring well installation, horizontal and vertical extent of waste verification and groundwater sampling and analysis.

1.3.3 Current Status

Based on reports and documents reviewed for the site, and a current assessment of all available information, the following summarizes the current status of conditions at the Albion-Sheridan Township Landfill.

The landfill is currently covered with 1 to 4 feet of silty sand with refuse scattered at the surface, including metal, plastic, concrete, asphalt, 55-gallon drums, wood, tires, a storage tank and a junk crane. Test pitting conducted by MDNR uncovered one area of concentrated drum disposal where an estimated 200 to 400 drums are present. Some of the drums contain liquid and solid wastes and suspected paint sludges, including up to 2.7 parts per million (ppm) arsenic, 730,000 ppm 1,2,4-trimethyl benzene, 40,000 ppm m&p xylenes, 6,500 ppm acetone and 2,400 ppm aluminum.

The landfill ranges from 16 to 35 feet in thickness and is producing landfill gasses in the form of volatile organic compounds (VOCs) in concentrations in excess of 10,000 ppm. The landfill waste contains numerous organic contaminants, including 10 VOCs, 19 semi-volatile compounds (SVOCs), 11 pesticides/PCBs, and inorganic contaminants including antimony, arsenic, chromium, copper, lead, mercury and zinc.

A leachate plume extends southwest of the landfill for approximately 900 feet and extends vertically to a depth of approximately 45 feet below the water table. The RI found landfill constituents in groundwater extending southwest of the landfill for approximately 900 ft and extending vertically to a depth of approximately 45 ft below the water table. The unconsolidated aquifer plume contained 1,2-dibromo-3-chloropropane and antimony at concentrations above their respective federal Maximum Contaminant Level (MCL). The bedrock aquifer plume

contained vinyl chloride at the MCL and arsenic above the MCL, at concentrations up to 126 µg/l.

The results of the Pre-Design Studies indicated that overall, shallow glacial monitoring well samples exhibited similar results as those obtained during the RI. The only organic compounds detected included vinyl chloride (MW03SG at 1.0 µg/l), chloroethane (MW07SG at 1.0 µg/l) and bis (2-Ethylhexyl) phthalate (MW05SG at 6.4 µg/l). Arsenic was detected in 2 wells, MW04SG and MW07SG, at concentrations of 7.9 µg/l and 13.2 µg/l, respectively. The results of the Pre-Design Studies also indicated that overall, bedrock monitoring well samples exhibited similar results as those obtained during the RI. There were no VOCs or SVOCs detected. The only inorganic analyte detected above the 50 µg/l MCL was Arsenic in MW06SB at 130 µg/l.

1.4 PROJECT OBJECTIVES

Data Quality Objectives are qualitative and quantitative statements which specify the quality of the data required to support decisions made during the O&M activities and are based on the end uses of the data collected. As such, different data uses may require different levels of data quality.

1.4.1 Specific Objectives And Associated Tasks - O&M Monitoring

Long-term groundwater monitoring will be used to evaluate the effectiveness of the cap integrity. The groundwater monitoring plan will provide pertinent background information and fulfill the requirements of the Michigan Solid Waste Rules under Act 641 and the Hazardous Waste Rules under Act 64.

The objective of the gas monitoring plan is to evaluate the concentrations of specific toxic pollutants that are regulated under Michigan Public Act 348 and to verify that the total cancer risk at the fence line does not exceed $1x10^{-6}$.

1.4.2 Project Target Parameters And Intended Data Usage - O&M Monitoring Program

Field Parameters

The following equipment will be used to obtain field parameter data:

Groundwater

- Water level meter for measuring groundwater depth/elevations
- Thermometer, conductivity meter, dissolved oxygen meter, oxidation-reduction meter, and pH meter for monitoring well development and sampling
- Bladder pump and dedicated tubing to be used for monitoring well sampling

Air Monitoring

Gas monitoring screening will be performed using specific monitors able to detect or quantify and methane.

Laboratory Parameters

The Project target limits (PTLs) are defined as those concentrations that laboratory analytical procedures should achieve to meet the project objectives. These PTLs should not be considered "cleanup" criteria at the site but rather laboratory performance criteria.

The Target Method Detection Limits (TMDLs) for groundwater to be used for laboratory analyses are in accordance with the TMDLs established by the Michigan Department of Natural Resources (MDNR) in MERA Operational Memorandum #6, Revision #4 dated September 13, 1995.

Groundwater

Groundwater samples from six monitoring wells for the O&M monitoring will be analyzed for arsenic and ammonia on a quarterly basis. Seven drinking water wells will be analyzed for TCL organics plus 1,2-dibromo-3-chloropropane, mercury, cyanide, chloride, sulfate, nitrate/nitrite and ammonia. Twelve monitoring wells will be sampled and analyzed on an annual basis for select metals (arsenic, aluminum, antimony, cobalt, manganese and nickel), select VOCs (benzene, 1,2-dibromo-3-chloropropane and vinyl chloride) and ammonia. Seventeen monitoring wells will be sampled as part of the five year review and will be analyzed for TCL organics and 1,2-dibromo-3-chloropropane and TAL inorganics. Detection limits are further discussed in Section 7.0 (see Tables 7-4 and 7-5).

Air Samples

Ambient air samples will be analyzed for select VOCs including: 1,2-dichloroethene, benzene, tetrachloroethene, chloroform, methylene chloride, vinyl chloride, 1,1-dichloroethene, trichlorethene, and carbon tetrachloride.

The results of the O&M Monitoring will be used to assess the effectiveness of the remedial action and to minimize exposure to landfill gas emissions.

1.4.3 Data Quality Objectives

EPA Guidance (U.S. EPA 1987) tailors the analytical methodology to watch the intended use of the data. In general, the five analytical levels are:

- Level I - field screening or analyses using portable instruments;
- Level II - field analyses using more sophisticated portable analytical instruments, possibly setup in a mobile laboratory;

- Level III - analyses performed at an off-site geotechnical or analytical laboratory but without the validation or documentation procedures required of the Contract Laboratory Program (CLP) Level IV analyses;
- Level IV - CLP (or CLP-like) routine analytical services; and
- Level V - analysis by non-standard methods;

Data validation procedures are provided in Section 9.0. To meet the objectives of the UAO, the following qualitative DQOs were identified:

Screening: The following measurements will be used under DQO Level I to collect and obtain basic site characteristics:

- Field Parameter Data: pH, temperature, specific conductance, oxidation-reduction potential, dissolved oxygen, and water levels/elevations
- Compile or acquire basic geologic and hydrogeologic information such as existing water table maps. These data will be used to further define migration pathways and background conditions in the area of the site.

The data acquired under DQO Level I will be used to detect changes in groundwater characteristics between sampling rounds, to describe basic physical properties of media investigated, and to verify adequate purging of monitoring wells. Water level elevations will be measured to map the water table and to calculate groundwater flow gradients by following standard contouring protocols.

Field Analysis: The following field analysis procedures will be used under DQO Level II. They will be used to generate data, if required, to evaluate the gas emissions from the landfill.

- Landfill gas samples: methane.
- DQO Level II data such as samples of landfill gas, will be used to assess the composition, relative quantity and location of gas production within the landfill area and to assess the presence of air emission constituents which are regulated under Michigan Public Act 348.

Off-site Laboratory Analyses Ambient Air Samples: This provides a level of data quality suitable for site characterization. Analyses may include mobile lab generated data and some analytical lab methods (e.g., laboratory data without DQO Level IV type quality control documentation).

Ambient air samples analyzed for chemicals of concerns (volatiles) will be required during the O&M Monitoring. The contract laboratory will use Method T0-14 for ambient air monitoring analyses.

Off-Site Laboratory Analyses Groundwater Samples: SW-846 analytical methods with an increased level of QA/QC will be used in place of CLP methodologies for groundwater sample analyses conducted during the O&M Monitoring. The data will be presented in CLP-type deliverables. Data validation procedures are performed according to U.S. EPA recognized

protocol. The methods are discussed in Section 7.0 and detection limits are discussed on Section 7.0.

Non-Standard Laboratory Analyses: No DQO Level V data are planned to be collected during the O&M Monitoring.

1.5 SAMPLE NETWORK DESIGN AND RATIONALE

The sample network design and rationale for sample locations is explained in detail in the PMP.

1.5.1 Laboratory Analysis Parameters and Sample Frequency

Sample matrices, analytical parameters and frequencies of sample collection is presented in Table 1-1.

1.5.2 Site Maps Of Sampling Locations

Maps showing intended ground water sampling locations are included as Figures in the O&M Plan, which is fully incorporated into this QAPP through reference. It is possible however, that depending on the nature of encountered field conditions some of these locations will be changed if approved by U.S. EPA. The person who shall be responsible for making such decisions will be the Site Field Manager whose responsibilities are described in Section 2.0 of this QAPP. Monitoring well screen depth are also indicated in the O&M Plan.

1.5.3 Rationale of Selected Sampling Locations

The rationale for why the selected sampling locations were chosen in conjunction with the area of concern is fully described in the O&M Plan and SOW.

A summary of the sampling and analysis plan for the O&M Monitoring is presented in Table 1-1 of this document. Table 1-1 will be revised by addenda if required, and prior to additional monitoring during subsequent phases of the O&M Monitoring Program.

1.6 PROJECT SCHEDULE

The initial quarterly groundwater sampling and analysis event will occur after cap construction is completed following EPA approval of the Final Construction Report. Thereafter, groundwater sampling and analysis will be conducted on a quarterly basis for the first five years of the monitoring program.

The sampling schedule may be modified in the future with the approval of U.S. EPA and consultation with MDEQ.

At the direction of the U.S. EPA's Remedial Project Manager, The Project Coordinator has overall responsibility for all phases of the RD/RA. The Project Coordinator assigned by Cooper Industries and Corning Corporation (Group) for this RD/RA project is Mr. John Seymour of Woodward-Clyde Consultants (WCC). The Project Coordinator will be responsible for the direction and supervision of work performed by the O&M Contractor pursuant to the UAO. The various quality assurance and management responsibilities of key project personnel are defined below.

2.1 PROJECT ORGANIZATION CHART

The lines of authority for the Remedial Action can be found in Figure 2-1. The chart includes all individuals discussed below.

2.2 MANAGEMENT RESPONSIBILITIES

2.2.1 U.S. EPA Remedial Project Manager

Mr. Jon Peterson has overall responsibility for all phases of the RD/RA. He will provide review and approval of work plans, QAPPs, reports, schedules, and specifications.

2.2.2 Group Authority and Responsibility

The Group will manage the overall project. The Group's Project Coordinator and the O&M Contractor's technical resources will be utilized as needed for specific areas of application and to accomplish specific tasks associated with the O&M Monitoring Program. The Group, Project Coordinator and the O&M Contractor will work together to assure that project resources are effectively utilized to meet schedules, budgets, and quality requirements.

The Group's responsibilities will include reporting to regulatory agencies, supervising and reviewing the Project Coordinator's and the O&M Contractor's work. This will assure that the work performed meets technical commitments, by evaluating permit condition compliance including scheduled commitments

2.2.3 Project Coordinator

Mr. John Seymour of WCC will be the Project Coordinator for the Group during the O&M activities. The Project Coordinator will report directly to the Group.

2.2.4 O&M Contractor's Project Manager

The O&M Contractor's Project Manager has overall responsibility for ensuring that the project meets U.S. EPA's objectives and quality standards. The Project Manager will provide assistance to the Group in terms of writing and distribution of the QAPP to all those parties connected with

the project (including the laboratory). The Project Manager is responsible for technical quality control and project oversight. The Project Manager will report directly to the Group.

2.3 QUALITY ASSURANCE RESPONSIBILITIES

The Group's QA Manager

The Group's QA Manager will remain independent of direct job involvement and day-to-day operations. He will have direct access to corporate executive staff, necessary to resolve any QA dispute. He is responsible for oversight of the QA program in conformance with the demands of specific investigations, the O&M Contractor's policies, and U.S. EPA requirements. Specific functions and duties include:

- Providing QA oversight on various phases of the field operations;
- Reviewing and approving of QA plans and procedures;
- Providing QA technical assistance to project staff;
- Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the remainder of the Group.

O&M Contractor's QA Manager

The O&M Contractor's QA Manager will report directly to the O&M Project Manager, and will be responsible for ensuring that all procedures for the O&M Monitoring Program are being followed. In addition, the QA Manager will be responsible for the data validation, verifying that sampling and analytical operations are carried out according to the Quality Assurance Project Plan. Audits of systems will also be conducted. The QA Manager or designee shall be responsible for performance and system audits of field, laboratory and data reduction/verification activities, and specifying corrective action as required. The QA Manager will review field QC test results, laboratory operations, and prepare QA reports.

U.S. EPA Region V Technical Support Section Quality Assurance Reviewer (RQAR)

The U.S. EPA RQAR has the responsibility to review and approve all Quality Assurance Project Plans (QAPPs). Additional EPA responsibilities for the project include:

- Conducting external Performance and System Audits of project laboratory(ies)
- Reviewing and evaluating analytical laboratory and field procedures

2.4 LABORATORY RESPONSIBILITIES

The Quanterra Environmental Services Laboratory in North Canton, Ohio, will perform analytical services during the O&M Monitoring Program. Specific analyses and matrices that

Quanterra laboratories will analyze and the protocols they will follow are described in other sections of this QAPP.

Quanterra Laboratories Project Manager - Ms. Alesia Danford

The Quanterra Laboratories Project Manager will report directly to the O&M Contractor's Project Manager. She will be responsible for the following:

- Ensuring all resources of the laboratory are available on an as-required basis; and
- Overviewing of final analytical reports.

Quanterra Laboratories Operations Manager - Mr. Chris Oprandi

The Quanterra Laboratories Operations Manager will report to the Quanterra Laboratories Project Manager and will be responsible for:

- Coordinating laboratory analyses Supervising in-house chain-of-custody
- Scheduling sample analyses
- Overseeing data review
- Overseeing preparation of analytical reports
- Approving final analytical reports prior to submission to the Group and the O&M Contractor

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Quanterra Laboratories Quality Assurance Officer - Ms. Opal Davis-Johnson

Quanterra's Laboratory QA Officer has the overall responsibility for data after it leaves the laboratory. The QA Officer will be independent of the laboratory but will communicate data issues through the laboratory's Project Manager. In addition, the laboratory QA Officer will:

- Overview laboratory quality assurance
- Overview QA/QC documentation
- Conduct detailed data review
- Determine whether to implement laboratory corrective actions
- Define appropriate laboratory QA procedures
- Prepare laboratory Standard Operation Procedures
- Sign the title page of the QAPP

Quanterra Laboratories Sample Custodian - Ms. Lois Ezzo

The sample custodian will report to the laboratory Operations Manager. Responsibilities of the sample custodian will include:

- Receiving and inspecting the incoming sample containers
- Recording the condition of the incoming sample containers
- Signing appropriate documents
- Verifying chain-of-custody and its correctness
- Notifying laboratory manager and laboratory supervisor of sample receipt and inspection
- Assigning a unique identification number and customer number, and entering each into the sample receiving log
- Initiating transfer of the samples to the appropriate lab sections, with the help of the laboratory manager
- ~~Controlling and monitoring access/storage of samples and extracts~~ JAD 10/14

Final responsibility for project quality rests with Quanterra's Project Manager. Independent quality assurance will be provided by the Quanterra's Project Manager and QA Officer prior to release of all data to the Group and the and the O&M Contractor.

Quanterra Laboratories Technical Staff

Quanterra Laboratories technical staff will be responsible for sample analysis and identification of corrective actions. The staff will report directly to the laboratory Operations Manager.

2.5 FIELD RESPONSIBILITIES

The Group will be supported by the O&M Contractor Field Manager. The Field Manager is responsible for leading and coordinating the day-to-day activities of the various resource specialists under his/her supervision. The Field Manager is an experienced environmental professional and will report directly to the O&M Contractor Project Manager. Specific Field Manager responsibilities include:

- Providing day-to-day coordination with his/her Project Manager on technical issues in specific areas of expertise;
- Developing and implementing field-related work plans, assurance of schedule compliance, and adherence to management-developed study requirements;
- Coordinating and managing field staff including sampling and drilling, and supervising field laboratory staff;
- Implementing QC for technical data provided by the field staff including field measurement data;
- Writing and approving text and graphics required for field team efforts;

- Coordinating and overseeing technical efforts of subcontractors assisting the field team;
- Identifying problems at the field team level, resolving difficulties in consultation with the Project Manager, implementing and documenting corrective action procedures, and providing communication between team and upper management; and
- Participating in data validation and in preparation of the final report.

2.6 CONTRACTORS

The Group anticipates contracting an O&M Manager (O&M Contractor), laboratory services, and related contractors for such services as drilling and surveying during the O&M Monitoring Program. The companies chosen will have contractual obligations to the Group but will work under the direction of the O&M Contractor. The Group will inform U.S. EPA when these services are contracted.

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody documentation, laboratory analysis, and reporting that will provide results that are of known quality and useable to meet project objectives. Specific procedures for calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP. This section addresses the specific objectives for completeness, representativeness, comparability, accuracy, and precision of analysis.

Data that are incidental to collecting samples for analytical testing or unrelated to sampling will be generated during many of the field activities. These activities include, but are not limited to:

- Documenting time and weather conditions
- Locating and measuring the elevation of sampling stations
- Determining depths in a well
- Static water level measurements
- Calculating well development and pre-sampling purge volumes
- Observing sample collection conditions

The general QA objective for such field data is to obtain reproducible and comparable measurements to a degree of accuracy consistent with the intended use of such data through the documented use of standard procedures.

3.1 PRECISION

3.1.1 Definition

Precision is defined as the reproducibility of the analysis under prescribed similar conditions. Any variability in the reported analysis is attributed to variability introduced by sampling, handling, or analytical procedures. Precision can be expressed as relative percent difference (RPD) between duplicate analyses or as percent relative standard deviation (%RSD) between multiple data points. Equations to calculate precision are given in Section 12.0.

3.1.2 Field Precision Objectives

- Precision goals for pH measurement for replicate samples are ± 0.2 standard pH units.
- Precision goals for the specific conductivity meter are consecutive readings with ten percent of each other. Precision will be assessed through replicate measurements.
- The precision of temperature readings will be assessed by performing replicate readings. These readings must be within one degree Celsius of the original readings.

- Precision of Oxidation/Reduction (Redox) Potential measurements will be assessed through replicate measurements. The replicate measurements must be within ± 5 millivolts of the original measurement.
- The precision of dissolved oxygen (DO) measurements will be accessed by performing replicate measurements. The replicate measurements must be within ± 0.2 mg/l of the original measurement.
- Precision goals for field screening of landfill gas emissions will be assessed by performing replicate readings.

3.1.3 Laboratory Precision Objectives

The precision of laboratory analyses will be measured by testing spiked samples and duplicates in accordance with the frequencies shown in Table 1-1. Matrix spikes and matrix spike duplicates will be analyzed for every ~~10~~ 20 investigative samples. Precision criteria for the parameters to be tested are shown in Table 3-1. 540 10 14

Additionally, one duplicate sample will be collected in the field for every 10 investigative groundwater samples. It will be labeled as a completely separate sample with no notation as to which original sample it duplicates, and it will be submitted as a blind duplicate sample to the lab. The same set of analyses as the original sample will be performed. Since the samples will not be spiked, there will be less information due to non-detected compounds. However, an RPD can be calculated for duplicate sample data in the same way as duplicate spiked samples. Because of matrix effects, no criteria are set for the RPD, but this information will be used in estimating uncertainty in the aggregate sampling and analytical precision for this project.

3.2 ACCURACY

3.2.1 Definition

Accuracy is defined as a bias in the measurement, either low or high from the true value. The accuracy or bias of a laboratory analysis is evaluated by analyzing standards of known concentration both before and during sample analysis. Bias also is evaluated by spiking a sample with a known quantity of a chemical and measuring its actual, versus expected, recovery. Similarly, any bias introduced by laboratory contaminants are detected during blank analysis. Accuracy can be expressed as percent recovery (%R) of a spiked analyte. The formula to calculate accuracy is presented in Section 12.0 of this QAPP.

3.2.2 Field Accuracy Objectives

The accuracy of field measurements of pH will be assessed through pre-measurement calibrations and post-measurements verifications using at least three standard buffer solutions. The calibration measurement must be within ± 0.1 standard units for the buffer solution values.

Post-measurement verification will be accomplished using different containers of buffer solutions than the container used for pre-measurement calibration.

The accuracy of field measurements for specific conductivity will be assessed by performing pre-measurement calibration and post-measurement verifications. The calibration measurement must be within ± 20 micromhos/cm of the true value of the calibration solution. Post-measurement verification will be accomplished using a different container of standard calibration solution than the container used for pre-measurement calibration.

The accuracy of field measurements of Redox will be assessed through pre-measurement calibrations and post-measurement verifications using a standard reference solution.

The accuracy of temperature readings will be ensured by using thermometers certified by the National Institute of Standards and Technology.

The accuracy of field measurements of DO will be assessed through pre-measurement calibration to ambient air and post measurement evaluation of instrument drift using ambient air as the reference.

Field screening of landfill gas emissions will be performed for methane. Accuracy objectives will be in accordance with the manufacturer's recommendations.

The accuracy of conductivity measurements will not be assessed during the investigation. The survey yields apparent indicators of conductivity to identify changes in this property; absolute or true values are not important to the investigation.

3.2.3 Laboratory Accuracy Objectives

The accuracy of laboratory analyses will be measured by testing of spiked samples in accordance with the frequencies shown in Table 1-1. Matrix spikes and matrix spike duplicates will be analyzed for every 20 investigative samples. Method blanks and Laboratory Control Samples (LCS) will be analyzed one for every analytical batch. Surrogates will be analyzed for every sample and every blank, spike, and control sample. Accuracy criteria for the parameters to be tested are shown in Tables 3-1 and 3-2 , WHERE APPROPRIATE,

3.3 COMPLETENESS

3.3.1 Definition

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was planned to be obtained or requested under normal conditions.

3.3.2 Field Completeness Objectives

Field completeness is a measure of the amount of valid measurements obtained from all the field measurements planned in the project. The equation for completeness is presented in Section 12.0 of this QAPP. Field completeness for this project will be greater than 90 percent.

3.3.3 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid measurements obtained (including estimated values) from all the measurements planned in a project. The equation for completeness is presented in Section 12.0 of this QAPP. Laboratory completeness for this project will be greater than 90 percent.

3.4 REPRESENTATIVENESS

3.4.1 Definition

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and proper laboratory protocol.

3.4.2 Measures to Ensure Representativeness of Field Data

Representiveness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the project standard operating procedures (SOPs) for field sampling (see Attachment A to the O&M Plan) are followed and that proper sampling techniques are used.

3.4.3 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory is ensured by using the proper analytical procedures, meeting sample holding times and analyzing and assessing field duplicated samples. The sampling network was designed to provide data representative of facility conditions. During development of this network, consideration was given to past waste disposal practices, existing analytical data, physical setting and processes, and constraints inherent to the Superfund program. The rationale of the sampling network is discussed in detail in the PMP.

3.5 COMPARABILITY

3.5.1 Definition

Comparability is an expression of the confidence with which one data set can be compared with another.

3.5.2 Measures to Ensure Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring the PMP is followed and that proper sampling techniques are used.

9.1 DATA REDUCTION

9.1.1 Field Data Reduction Procedures

Field measurements are taken directly from instrument readings; therefore, no data calculations are involved. Field data reduction consists of transcribing and organizing these data into tables. This task will be performed by the Contractor's O&M Field Team and Field Manager.

9.1.2 Laboratory Data Reduction Procedures

Laboratory data reduction procedures will be followed according to the following protocol:

- Raw data produced and checked by the responsible analyst is turned over for independent review by another analyst
- The area supervisor or senior chemist reviews the data for attainment of quality control criteria established by the QAPP (see Tables 3-1, 3-2, and 4-1)
- Upon completion of all reviews and acceptance of the raw data by the laboratory area supervisor, a report will be generated and sent to the laboratory Project Manager
- The laboratory Project Manager will complete a thorough inspection of all reports
- The QA Officer and/or area supervisor will decide whether any sample reanalysis is required
- Upon acceptance of the preliminary reports by the QA Officer, final reports will be generated and signed by the Project Manager

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Specific equations used for data reduction are contained in the SOPs in Attachment A.

9.2 DATA VALIDATION

Data validation procedures will be performed for both field and laboratory operations as described in the following subsections.

9.2.1 Procedures Used to Evaluate Field Data

Procedures to evaluate field data for this project primarily include checking for transcription errors and review of field logbooks, on the part of field sampling team. This task will be the responsibility of the Field Manager.

9.2.2 Procedures to Validate Laboratory Data

Validation of the analytical data will be performed by the O&M Contractor's QA Officer or designee based on the pertinent evaluation criteria outlined in "National Functional Guidelines

for Organic Data Review", February 1994 and "National Functional Guidelines for Inorganic Data Review", February 1994, on 100 percent of the data as described below:

The following deliverables will be evaluated in the data validation:

Organic Analyses

i) technical holding times
ii) GC/MS tuning/mass calibration
iii) initial and continuing calibration
iv) blanks
v) surrogate spikes
vi) MS/MSD results
vii) internal standard performance
viii) target compound identification and quantitation
~~ix) tentatively identified compounds~~ JAO 10/14
x) system performance
xi) GC/ECD instrument performance check (Pesticides/PCBs)
xii) pesticide cleanup checks, if performed (Pesticides/PCBs)
xiii) field duplicates

Inorganic Analyses

i) technical holding times
ii) calibration
iii) blanks
iv) interference check samples
v) laboratory control samples
vi) duplicate sample analysis
vii) matrix spike sample analysis
viii) furnace atomic absorption QC
~~ix) ICP serial dilution~~ JAO 10/14
x) sample result verification
xi) field duplicates

9.3 DATA REPORTING

Data reporting procedures will be carried out for field and laboratory operations as described in the following subsections.

9.3.1 Field Data Reporting

Field data reporting will be conducted principally through the transmission of report sheets containing tabulated results of all measurements made and documentation of all calibration activities.

9.3.2 Laboratory Data Reporting

The task of reporting laboratory data to the U.S. EPA begins after the validation activity has been concluded. The laboratory Project Manager will perform a final review of the report summaries and case narratives to determine whether the report meets the project requirements. In addition to the record of the chain-of-custody, the report format shall consist of the following:

1. Case Narrative
   - i) date of issuance
   - ii) laboratory analysis performed
   - iii) any deviations from intended analytical strategy
   - iv) laboratory batch number
   - v) number of samples and respective matrices
   - vi) quality control procedures utilized and also references to the acceptance criteria
   - vii) laboratory report contents
   - viii) project name and number
   - ix) condition of samples "as received"
   - x) discussion of whether or not sample holding times were met
   - xi) discussion of technical problems or other observations which may have created analytical difficulties
   - xii) discussion of any laboratory quality control checks which failed to meet project criteria
   - xiii) signature of laboratory ~~QA Manager~~ PROJECT MANAGER JAY 10/14

2. Chemistry Data Package

   i) case narrative for each analyzed batch of samples

   ii) cross referencing of laboratory sample to project sample identification numbers

   iii) description of data qualifiers to be used

   iv) methods of sample preparation and analyses for samples

   v) sample results

   vi) raw data for sample results and laboratory quality control samples

   vii) results of (dated) initial and continuing calibration checks and GC/MS tuning results

   viii) matrix spike and matrix spike duplicate recoveries, laboratory duplicate analytical results, laboratory control samples, method blank results, calibrations check compounds and system performance check compound results

   ix) labeled and dated chromatograms/spectra/instrument output of sample results and laboratory quality control checks

   ~~x) results of tentatively identified compounds~~ JAO 10/14

The data package submitted will be a "CLP-like" data package consisting of all the information presented in a CLP data package but not necessarily on CLP forms.

Performance and system audits conducted by the O&M Contractor shall be performed to:

- Verify that QA program is documented in accordance with specified requirements
- Verify documented program has been implemented
- Assess the Effectiveness of the QAPP
- Identify any non conformances
- Verify correction of identified deficiencies

This QA program operates independently of the overall project structure. The Audit Flowchart (Figure 10-1) summarizes the audit procedures established in this section. The O&M Contractor's Quality Assurance Officer (QAO) shall be responsible for initiating audits, selecting the audit team and overseeing the audit implementation. The QAO in consultation with the O&M Contractor's Project Manager, shall perform audits to coincide with appropriate activities on this project.

10.1 FIELD PERFORMANCE AND SYSTEMS AUDITS

Internal system audits on field work performance will be conducted by the O&M Contractor's QAO at least once yearly and as considered appropriate throughout the duration of the project. The Field Manager is responsible for supervising and checking that samples are collected and handled in accordance with the approved project plans and that documentation of field work is adequate and complete. The Project Manager is responsible for overseeing that the project performance satisfies the QA objectives, as set out in this QAPP. The O&M Contractor's QAO may also conduct unannounced field audits.

A field audit checklist (Figure 10-2) will be used to conduct field audits at the site during any phase of the RD/RA. Audits will examine adherence to protocol specified for items such as sample collection, sample handling, QA/QC sample collection, equipment calibration, equipment maintenance, field logbook documentation, and chain-of-custody preparation.

Follow-up audits may be performed to verify that any previously identified deficiencies were corrected. Corrective actions (Section 13.0) may be identified and recommended. An external audit may be conducted by U.S. EPA Region V personnel at any time.

10.2 LABORATORY PERFORMANCE AND SYSTEMS AUDITS

10.2.1 Internal Laboratory Audit Responsibilities

The internal laboratory audit will be conducted by the O&M Contractor's QAO.

10.2.2 Internal Laboratory Audit Frequency

The internal laboratory system audits will be performed on an annual basis while the internal laboratory performance audits will be conducted on a quarterly basis over the duration of O&M Monitoring Program any time laboratory analyses are required.

10.2.3 Internal Laboratory Audit Procedures

The internal laboratory system audits will include an examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation and analysis, and instrument operating records. The performance audits will involve preparing blind QC samples and submitting them along with project samples to the laboratory for analysis throughout the project. The O&M Contractor's QAO will evaluate the analytical results of these blind performance samples to ensure the laboratory maintains acceptable QC performance.

Follow-up audits may be performed to verify that any previously identified deficiencies were corrected. Corrective actions (Section 13.0) may be identified and recommended.

10.2.4 External Laboratory Audit Frequency

An external laboratory audit will be conducted at least once prior to the initiation of the sampling and analysis activities. These audits may or may not be announced and are at the discretion of the U.S. EPA.

10.2.5 Overview of the External Laboratory Audit Process

External laboratory audits will include (but not be limited to) review of laboratory analytical procedures, laboratory on-site audits, and/or submission of performance evaluation samples to the laboratory for analysis.

11.1 FIELD INSTRUMENT PREVENTIVE MAINTENANCE

Standard Operating Procedures are presented in Attachment A of the O&M Plan. Table 11-1 provides the frequency of service for field instruments.

11.2 LABORATORY INSTRUMENT PREVENTIVE MAINTENANCE

As part of their QA/QC program, a routine preventive maintenance program is conducted by Quanterra to minimize the occurrence of instrument failure and other system malfunctions. Designated laboratory employees will regularly perform routine scheduled maintenance and repair of (or coordinate with the instrument manufacturer for the repair of) all instruments. All maintenance that is performed shall be documented in the laboratory's maintenance logbooks. All laboratory instruments are maintained in accordance with manufacturer's specifications.

Table 11-1 provides the frequency which components of key analytical instruments or equipment will be serviced.

12.1 CALCULATION OF DATA QUALITY INDICATORS

Quanterra uses specific routine procedures to assess the precision, accuracy, and completeness of its analytical data. The Laboratory's objective for precision and accuracy is to equal or exceed the stated performance in the method. These measures include the validation and internal quality control procedures discussed in Sections 7 and 8.

Precision, Accuracy and Completeness

Quantitation of precision and accuracy for field measurements are described in Section 3.0.

Specific procedures for assessing data accuracy and precision include calculation of percent recoveries for all laboratory check samples (LCS) and surrogates and relative percent differences (RPD) for all duplicate spike sample analyses. These calculations are summarized below.

a. Accuracy = Percent Recovery = $\frac{\text{(Amount in spiked sample - Amount in sample) x 100}}{\text{(R\%) (Known amount added)}}$

b. Precision = RPD = $\frac{\text{(Amount in Spike 1 - Amount in Spike 2) x 100}}{\text{0.5 (Amount in Spike 1 + Amount in Spike 2)}}$

c. Completeness = $\frac{\text{number of valid measurements obtained x 100}}{\text{number of measurements planned}}$

NOTE: Refer to the definitions of accuracy, precision, and completeness in Section 3.0.

Corrective actions may be required for two classes of problems: analytical and equipment problems and noncompliance problems. Analytical and equipment problems may occur during sampling, sample handling, sample preparation, laboratory instrumental analysis, and data review.

For noncompliance problems, formal corrective action will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the O&M Contractor's Project Manager and Quality Assurance Officer (QAO) who will notify the U.S. EPA Remedial Project Manager and/or the U.S. EPA QAO. Implementation of corrective action will be confirmed in writing through the same channels.

Any non conformance with established quality control procedures in this QAPP will be identified and corrected in accordance with this QAPP. The O&M Contractor's QAO or designee will issue a Non conformance Report for each non conformance condition.

Corrective actions will be implemented and documented in the field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by the Group, the O&M Contractor's Project Manager, or the U.S. EPA Remedial Project Manager.

13.1 FIELD CORRECTIVE ACTION

Technical staff and project personnel will be responsible for reporting all suspected technical or QA non conformance or suspected deficiencies of any activity or used document by reporting the situation to the Field Manager or designee. This manager will be responsible for assessing the suspected problems in consultation with the O&M Contractor's QAO and Project Manager and making a decision based on the potential for the situation to impact the quality of the data. If the situation warrants a corrective action, then a non conformance report will be initiated by the Field Manager.

The Field Manager will be responsible for ensuring that corrective action for non conformances are initiated by:

- evaluating all reported non conformances
- controlling additional work on non conforming items
- determining disposition or action to be taken
- maintaining a log of non conformances
- reviewing non conformance reports and corrective actions taken
- ensuring non conformance reports are included in the final site documentation in project files

If appropriate, the Field Manager will ensure that no additional work that is dependent on the non conformance activity is performed until the corrective actions are completed.

Corrective action for field measures may include:

- repeat the measurement to check the error
- check for all proper adjustments for ambient conditions such as temperature
- check the batteries
- re-calibration
- replace the instrument or measurement devices
- stop work (if necessary)

The Field Manager is responsible for all site activities. In this role, the Field Manager at times is required to adjust procedures to accommodate site-specific needs.

Any change in procedures will be documented and signed by the initiators and the Field Manager. Each document will be numbered serially as required, and attached to the field copy of the affected document.

The Field Manager is responsible for the controlling, tracking, and implementation of the identified field changes. Reports on all changes will be distributed to all affected parties including the U.S. EPA. The O&M Contractor and U.S. EPA Remedial Project Manager will be notified whenever program changes in the field are made.

13.2 LABORATORY CORRECTIVE ACTION

Corrective action in the laboratory may occur prior to, during, and after initial analyses. A number of conditions such as broken samples containers, multiple phases, low/high pH readings, and potentially high concentration samples may be identified during sample log-in or just prior to analysis. Following consultation with lab analysts and section leaders, it may be necessary for Quanterra's Quality Assurance Officer to approve the implementation of corrective action. The submitted SOPs specify some conditions during or after analysis that may automatically trigger corrective action or optional procedures. These conditions may include dilution of samples, additional sample extract cleanup, automatic reinjection/reanalysis when certain quality control criteria are not met, etc. A summary of method-specific corrective actions are found in this QAPP.

The bench chemist will identify the need for corrective action. The Quanterra QAO in consultation with the Quanterra supervisor and staff, will approve the required corrective action to be implemented by the laboratory staff. The Quanterra QA manager will ensure implementation and documentation of the corrective action. If the non conformance causes project objectives not to be achieved, it will be necessary to inform all levels of project management including the U.S. EPA Remedial Project Manager to concur with the corrective action.

These corrective actions are performed prior to release of the data from the laboratory. The corrective action will be documented in both the Quanterra's corrective action log (signed by analyst, section leader and quality control coordinator), and the narrative data report sent from

Quanterra to the O&M Contractor's QAO. If corrective action does not rectify the situation, Quanterra will contact the U.S. EPA Remedial Project Manager.

13.3 CORRECTIVE ACTION DURING DATA VALIDATION AND DATA ASSESSMENT

The O&M Contractor's QAO may identify the need for corrective action during either the data validation or data assessment. Potential types of corrective action may include resampling by the field team or reinjection/reanalysis of samples by the laboratory.

These actions are dependent upon the ability to mobilize the field team and whether the data to be collected are necessary to meet the required quality assurance objectives. When the O&M Contractor's QAO (or designee) identifies a corrective action situation, it is the Group who will be responsible for approving the implementation of corrective action, including resampling, during data assessment. All corrective actions of this type will be documented by the Group and O&M Contractor's QAO.

The deliverables associated with the tasks identified in the PMP and monthly progress reports will contain separate QA sections in which data quality information collected during the task is summarized. Those reports will be the responsibility of the Group and will include the Group and O&M Contractor's Quality Assurance Officer reports on the accuracy, precision, and completeness of the data as well as the results of the performance and system audits, and any corrective action needed or taken during the project.

14.1 CONTENTS OF PROJECT QA REPORTS

The QA reports will contain on a routine basis all results of field and laboratory audits, all information generated during the past month reflecting on the achievement of specific data quality objectives, and a summary of corrective action that was implemented, and its immediate results on the project. The status of the project with respect to the Project Schedule will be reported. Whenever necessary, updates on training provided, changes in key personnel, anticipated problems in the field or lab for the coming month that could bear on data quality along with proposed solutions, will be reported. Detailed references to QAPP modifications will be reported. All QA reports will be prepared in written, final format by the Group or designee.

In the event of an emergency, or in case it is essential to implement corrective action immediately, QA reports can be made by telephone to the appropriate individuals, as identified in the Project Organization or Corrective Action sections of this QAPP. However, these events, and their resolution will be addressed thoroughly in the next issue of the monthly QA report.

14.2 FREQUENCY OF QA REPORTS

The QA Reports will be prepared on a monthly basis and will be delivered to all recipients by the 10th day of each month. The reports will continue without interruption, until the project is completed. The frequency of any emergency reports that must be delivered verbally cannot be estimated at the present time.

14.3 INDIVIDUALS RECEIVING/REVIEWING QA REPORTS

The following individuals outside of the Group will receive copies of the monthly QA report:

U.S. EPA	-	Jon Peterson
Project Coordinator	-	J. Seymour, Woodward Clyde Consultants
O&M Contractor	-	*Insert Name*, Project Manager
	-	*Insert Name*, QA Officer
	-	*Insert Name*, Field Manager
MDEQ	-	Kim Sakowski
Quanterra	-	Alesia Danford

United States Environmental Protection Agency, 1995, Unilateral Administrative Order, U.S. EPA Docket No. V-W-96-C-316.

United States Environmental Protection Agency Region V, 1996, Region 5 Model QA Project Plan, January 1996.

MDNR, 1990, Michigan Environmental Response Act - 1982 Public Act 307, as amended Administrative Rules, Michigan Department of Natural Resources Environmental Response Division.

MDNR, 1995, Environmental Response Division Operational Memorandum #6, Revision #4, September 13, 1995.

United States Environmental Protection Agency, 1986, RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, Washington D.C., September 1986, OSWER-9950.1.

United States Environmental Protection Agency, 1987a, Data Quality Objectives For Remedial Response Activities: Development Process, Washington D.C., March 1987, EPA 540/G-87/003.

United States Environmental Protection Agency, 1987b, Data Quality Objectives For Remedial Response Activities: Example Scenario RI/FS Activities at a Site With Contaminated Soil and Ground Water, Washington D.C., March 1987, EPA 540/G-87/004.